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Health informatics — Personal health device communication —

Part 10441: Device specialization — Cardiovascular fitness and activity monitor

Informatique de santé — Communication entre dispositifs de santé personnels —

Partie 10441: Spécialisation des dispositifs — Moniteur d'activité et de forme cardiovasculaire

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York • NY 10016-5997, USA
E-mail stds.ipr@ieee.org
Web www.ieee.org

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ISO/IEEE 11073-10441 was prepared by the 11073 Committee of the Engineering in Medicine and Biology Society of the IEEE (as IEEE 11073-10441-2013). It was adopted by Technical Committee ISO/TC 215, *Health informatics*, in parallel with its approval by the ISO member bodies, under the “fast-track procedure” defined in the Partner Standards Development Organization cooperation agreement between ISO and IEEE. IEEE is responsible for the maintenance of this document with participation and input from ISO member bodies.

ISO/IEEE 11073 consists of the following parts, under the general title *Health informatics — Personal health device communication* (text in parentheses gives a variant of subtitle):

— *Part 00103: Overview*

— *Part 10101: (Point-of-care medical device communication) Nomenclature*

— *Part 10102: (Point-of-care medical device communication) Nomenclature — Annotated ECG*

— *Part 10103: (Point-of-care medical device communication) — Nomenclature — Implantable device, cardiac*

— *Part 10201: (Point-of-care medical device communication) Domain information model*

— *Part 10404: Device specialization — Pulse oximeter*

— *Part 10406: Device specialization — Basic electrocardiograph (ECG) (1- to 3-lead ECG)*

— *Part 10407: Device specialization — Blood pressure monitor*

— *Part 10408: Device specialization — Thermometer*

— *Part 10415: Device specialization — Weighing scale*

— *Part 10417: Device specialization — Glucose meter*

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— *Part 10420: Device specialization — Body composition analyzer*

— *Part 10421: Device specialization — Peak expiratory flow monitor (peak flow)*

— *Part 10441: Device specialization — Cardiovascular fitness and activity monitor*

— *Part 10442: (Point-of-care medical device communication) Device specialization — Strength fitness equipment*

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— *Part 20101: (Point-of-care medical device communication) Application profiles — Base standard*

— *Part 20601: Application profile — Optimized exchange protocol*

— *Part 30200: (Point-of-care medical device communication) Transport profile — Cable connected*

— *Part 30300: (Point-of-care medical device communication) Transport profile — Infrared wireless*

— *Part 30400: (Point-of-care medical device communication) Interface profile — Cabled Ethernet*

— *Part 90101: (Point-of-care medical device communication) Analytical instruments — Point-of-care test*

— *Part 91064: (Standard communication protocol) Computer-assisted electrocardiography*

— *Part 92001: (Medical waveform format) — Encoding rules*

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USA

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Health informatics—Personal health device communication

Part 10441: Device specialization—Cardiovascular fitness and activity monitor

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Abstract: Within the context of the ISO/IEEE 11073 family of standards for device communication, a normative definition of communication between personal telehealth cardiovascular fitness and activity monitor devices and managers (e.g., cell phones, personal computers, personal health appliances, and set top boxes) is established in this standard in a manner that enables plug-and-play interoperability. Appropriate portions of existing standards are leveraged including ISO/IEEE 11073 terminology, information models, application profile standards, and transport standards. The use of specific term codes, formats, and behaviors in telehealth environments restricting optionality in base frameworks in favor of interoperability is specified. A common core of communication functionality for personal telehealth cardiovascular fitness and activity monitor devices is defined in this standard.
Keywords: activity monitor, cardiovascular fitness, IEEE 11073-10441™, medical device communication, personal health devices

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

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Introduction

This introduction is not part of IEEE Std 11073-10441-2013, IEEE Standard for Health informatics—Personal health device communication—Device specialization—Cardiovascular fitness and activity monitor.

ISO/IEEE 11073 standards enable communication between medical devices and external computer systems. This document uses the optimized framework created in IEEE Std 11073-20601a™-2010[a] and describes a specific, interoperable communication approach for cardiovascular fitness and activity monitors. These standards align with, and draw on, the existing clinically focused standards to provide easy management of data from either a clinical or a personal health device.

[a] Information on references can be found in Clause 2.

Contents

Health informatics—Personal health device communication

Part 10441: Device specialization—Cardiovascular fitness and activity monitor

1. Overview

1.1 Scope

Within the context of the ISO/IEEE 11073 family of standards for device communication, this standard establishes a normative definition of the communication between personal cardiovascular fitness and activity monitoring devices and managers (e.g., cell phones, personal computers, personal health appliances, and set top boxes) in a manner that enables plug-and-play interoperability. It leverages appropriate portions of existing standards including ISO/IEEE 11073 terminology and information models. It specifies the use of specific term codes, formats, and behaviors in telehealth environments restricting optionality in base frameworks in favor of interoperability. This standard defines a common core of communication functionality for personal telehealth cardiovascular fitness and activity monitor devices. In this context, cardiovascular fitness and activity monitor devices are being used broadly to cover cardiovascular fitness and activity monitor devices that measure physical actions and the body's various physiological responses to that activity.

1.2 Purpose

This standard addresses a need for an openly defined, independent standard for controlling information exchange to and from personal health devices and managers (e.g., cell phones, personal computers, personal health appliances, and set top boxes). Interoperability is the key to growing the potential market for these devices and to enabling people to be better informed participants in the management of their health.

1.3 Context

See IEEE Std 11073-20601a-2010[1] for an overview of the environment within which this standard is written.

This document defines the device specialization for the cardiovascular fitness and activity monitor being a specific agent type, and it provides a description of the device concepts, its capabilities, and its implementation according to this standard.

This standard is based on IEEE Std 11073-20601a-2010 and ISO/IEEE 11073-20601:2010(E), which in turn draw information from both ISO/IEEE 11073-10201:2004 [B7] and ISO/IEEE 11073-20101:2004 [B8].[2] The medical device encoding rules (MDERs) used within this standard are fully described in ISO/IEEE 11073-20601:2010(E).

This standard reproduces relevant portions of the nomenclature found in ISO/IEEE 11073-10101:2004 [B6] and adds new nomenclature codes for the purposes of this standard. Between this standard, ISO/IEEE 11073-20601:2010(E), and IEEE Std 11073-20601a-2010, all required nomenclature codes for implementation are documented.

NOTE 1—IEEE Std 11073-20601a-2010 is an amendment to ISO/IEEE 11073-20601:2010(E). It contains new material and corrections and does not copy the content of ISO/IEEE 11073-20601:2010(E). Throughout this standard, a reference to IEEE Std 11073-20601a-2010 refers to the document that is obtained after applying this new material and corrections to ISO/IEEE 11073-20601:2010(E).[3]

NOTE 2— In this standard, ISO/IEEE P11073-104zz is used to refer to the collection of device specialization standards that utilize IEEE Std 11073-20601a-2010, where zz can be any number from 01 to 99, inclusive.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so that each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

IEEE Std 11073-20601a™-2010, Health informatics—Personal health device communication—Application profile—Optimized Exchange Protocol—Amendment 1.[4,5]

ISO/IEEE 11073-20601:2010(E), Health informatics—Personal health device communication—Application profile—Optimized Exchange Protocol.[6]

[1] Information on references can be found in Clause 2.
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See Annex A for all informative material referenced by this standard.

3. Definitions, acronyms, and abbreviations

3.1 Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause.[7]

agent: A node that collects and transmits personal health data to an associated manager.

class: In object-oriented modeling, a class describes the attributes, methods, and events that objects instantiated from the class utilize.

device: A term used to refer to a physical apparatus implementing either an agent or a manager role.

handle: An unsigned 16-bit number that is locally unique and identifies one of the object instances within an agent.

manager: A node receiving data from one or more agent systems. Some examples of managers include a cellular phone, health appliance, set top box, or a computer system.

mass: An intrinsic property of matter that can be measured using the effect of the gravitational field on an object.

obj-handle: *See*: **handle**.

object: In object-oriented modeling, a particular instantiation of a class. The instantiation realizes attributes, methods, and events from the class.

personal health device: A device used in personal health applications.

personal telehealth device: *See*: **personal health device**.

proportional integral mode (PIM): This mode is defined as the integral of a variable with respect to one of its axes over the duration of the session or subsession. It is used in actigraphy to provide an activity measurement.

root mean square (RMS): The square root of the average of the squares of a variable over the duration of the session or subsession.

time above threshold (TAT): This is defined as the total time that an input variable exceeds a given threshold value over the duration of the session or subsession. It is used in actigraphy to provide an activity measurement.

weight: The force that results from the exertion of gravity on an object. The weight is directly propotional to the mass of the object**.** However, in the healthcare domain, the term “body weight” is typically used to denote the body mass of a person. This notation applies also to this standard.

[6] ISO/IEC publications are available from the ISO Central Secretariat (http://www.iso.org/). ISO publications are also available in the United States from the American National Standards Institute (http://www.ansi.org/).
[7] The *IEEE Standards Dictionary Online* subscription is available at http://www.ieee.org/portal/innovate/products/standard/standards_dictionary.html.

3.2 Acronyms and abbreviations

2D	two-dimensional
3D	three-dimensional
APDU	application protocol data unit
ASN.1	Abstract Syntax Notation One
DIM	domain information model
ICS	implementation conformance statement
MDC	medical device communication
MDS	medical device system
MOC	managed object class
PHD	personal health device
PIM	proportional integral mode
RPM	revolutions per minute
RMS	root mean square
RT-SA	real-time sample array
TAT	time above threshold
VMO	virtual medical object
VMS	virtual medical system

4. Introduction to ISO/IEEE 11073 personal health devices

4.1 General

This standard and the remainder of the series of ISO/IEEE 11073 personal health device (PHD) standards fit in the larger context of the ISO/IEEE 11073 series of standards. The full suite of standards enables agents to interconnect and interoperate with managers and with computerized healthcare information systems. See IEEE Std 11073-20601a-2010 for a description of the guiding principles for this series of ISO/IEEE 11073 Personal Health Device standards.

IEEE Std 11073-20601a-2010 supports the modeling and implementation of an extensive set of personal health devices (PHDs). This standard defines aspects of the cardiovascular fitness and activity monitor device. It describes all aspects necessary to implement the application layer services and data exchange protocol between an ISO/IEEE 11073 PHD cardiovascular fitness and activity monitor agent and a manager. This standard defines a subset of the objects and functionality contained in IEEE Std 11073-20601a-2010 and extends and adds definitions where appropriate. All new definitions are given in Annex B in Abstract Syntax Notation One (ASN.1) (ITU-T Rec. X.680-2002 [B9]). Nomenclature codes referenced in this standard, which are not defined in IEEE Std 11073-20601a-2010, are normatively defined in Annex C.

4.2 Introduction to ISO/IEEE 11073-20601 modeling constructs

4.2.1 General

The ISO/IEEE 11073 series of standards, and in particular IEEE Std 11073-20601a-2010, is based on an object-oriented systems management paradigm. The overall system model is divided into three principal components: the domain information model (DIM), the service model, and the communication model. See IEEE Std 11073-20601a-2010 for a detailed description of the modeling constructs.

4.2.2 Domain information model

The DIM is a hierarchical model that describes an agent as a set of objects. These objects and their attributes represent the elements that control behavior and report on the status of the agent and data that an

agent can communicate to a manager. Communication between the agent and the manager is defined by the application protocol in IEEE Std 11073-20601a-2010.

4.2.3 Service model

The service model defines the conceptual mechanisms for the data exchange services. Such services are mapped to messages that are exchanged between the agent and the manager. Protocol messages within the ISO/IEEE 11073 series of standards are defined in ASN.1. The messages defined in IEEE Std 11073-20601a-2010 can coexist with messages defined in other standard application profiles defined in the ISO/IEEE 11073 series of standards.

4.2.4 Communication model

In general, the communication model supports the topology of one or more agents communicating over logical point-to-point connections to a single manager. For each logical point-to-point connection, the dynamic system behavior is defined by a connection state machine as specified in IEEE Std 11073-20601a-2010.

4.2.5 Implementing the models

An agent implementing this standard shall implement all mandatory elements of the information, service, and communication models as well as all conditional elements where the condition is met. The agent should implement the recommended elements, and it may implement any combination of the optional elements. A manager implementing this standard shall utilize at least one of the mandatory, conditional, recommended, or optional elements. In this context, "utilize" means to use the element as part of the primary function of the manager device. For example, a manager whose primary function is to display data would need to display a piece of data in the element in order to utilize it.

4.3 Compliance with other standards

Devices that comply with this standard may also be required to comply with other domain and device specific standards that supersede the requirements of this standard with respect to issues including safety, reliability, and risk management. A user of this standard is expected to be familiar with all other such standards that apply and to comply with any higher specifications thus imposed. Typically, medical devices will comply with the IEC 60601-1:2005 [B1] base standards with respect to electrical and mechanical safety and any device specific standard as might be defined in the IEC 60601-2 series of standards [B2]. Software aspects may apply through standards such as IEC 62304:2006/EN 62304:2006 [B3]. Devices that comply with this standard implement higher layers of network software and utilize lower layers as appropriate to the application. The requirements on performance of such applications and conformance are defined elsewhere and are outside the scope of this standard. Moreover, the use of any medical equipment is subject to risk assessment and risk management appropriate to the application. Some relevant examples are ISO 14971:2007 [B5] and IEC 80001-1:2010 [B4]. The requirements of such risk assessment and risk management and conformance are outside the scope of this standard.

5. Cardiovascular fitness and activity monitor device concepts and modalities

Cardiovascular fitness and activity monitor agents measure the physical activity of an individual and record the physiological response to that activity. Agents include treadmills, exercise bikes, heart rate monitors, bike computers, pedometers, and overall activity/lifestyle monitors. Although there is great variety in the forms of these agents, there is significant commonality and overlap in the measurements they make.

5.1 General concepts

Agents in this category typically measure activity over a period of time called a session (see 6.9.4 for details).

One mode of operations is to provide session summaries once a session is closed. The data associated with a session may vary greatly from agent to agent. Minimally, the session will include information about the date and time of the session, as well as the session duration and the activity that was measured during the session. In addition, there may be a variety of metrics calculated for the entire session, like total distance or mean speed. In some agents, the concept of subsessions is important. These subsessions provide a mechanism to break up a session into smaller components that represent specific periods within the session. The primary example of this is the lap concept, where an agent may allow users to mark when they have completed a lap to be more granular in their data organization. Like a session, subsessions may have a variety of metrics that apply across the entire subsession, reporting either the mean, maximum, or minimum values over the session/subsession (i.e., subsession distance and mean speed).

Another mode of operations is to perform continuous monitoring while sessions and subsessions are in progress; this is to collect metrics either periodically or episodically or both along with their timestamps at a given sampling period. This allows applications to display progress during sessions and subsessions.

Raw data that are generated at much higher frequencies (maybe hundreds of time per second) can also be collected though continuous monitoring sessions and transmitted to the manager without information loss. This type of data requires the use of special ISO/IEEE 20601 metrics known as real-time sample array (RT-SA) objects and is restricted to periodic.

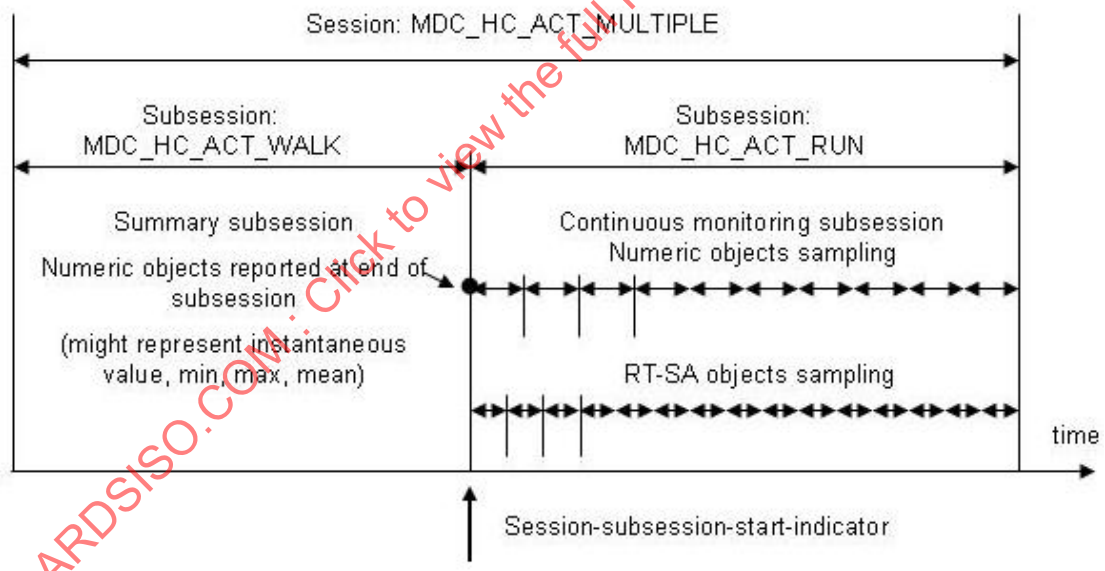

Figure 1—Sessions, subsessions, and their sampling rates

Figure 1 provides an illustration of the sessions, subsessions, and their different methods of reporting data. In this example, a multiple session is made of a walking subsession followed by a running subsession. The first subsession is a summary subsession providing a single point of measurement at the end of the subsession. This data point might represent the instantaneous value, the minimum, the maximum, or the average value of objects. The second subsession is started with the session-subsession-start-indicator marking a continuously monitoring subsession where data are reported periodically. As such, one set of measurements (such as the heart rate) is sampled at a given frequency using ISO/IEEE 20601 numeric

metric objects, while a second set of measurements (such as accelerometer data) RT-SA objects might be sampled at another much higher frequency using ISO/IEEE 20601 RT-SA objects.

Session summaries are used in the pedometer profile (see Clause 11), whereas session continuous monitoring are mandatory for the activity monitor profile (see Clause 12).

In 5.2 through 5.39, objects are presented in alphabetical order to allow an easy navigating of the document.

5.2 3D Acceleration (RT-SA)

Three-dimensional (3D) vector components (X, Y, Z, and Z-with-gravity-offset) of raw accelerometer sensory data. One vector is generated at each clock sample of the accelerometer. These components might be used to construct a two-dimensional (2D) or 3D vector in a scanner. Raw data are sometimes processed within devices like pedometers for fine trajectory calculation, spent energy, and so on. In some cases, these data are sent to the manager for further processing.

5.3 3D Angular acceleration (RT-SA)

3D vector components (X, Y, and Z), respectively, for pitch, roll, and yaw of raw angular accelerometer sensor (e.g., gyroscopes). One vector is generated at each clock sample of the gyroscope. These components might be used to construct a 2D or 3D vector in a scanner. Raw data are sometimes processed within devices like gaming remote controls or activity monitors for fine trajectory calculation, stabilization, and so on. In some cases, these data are sent to the manager for further processing.

5.4 Activity intensity (numeric)

This measurement reports the intensity of a certain activity. It is expected to be used as a supplement to the program identifier to describe the nature of the activity (e.g., slow running, moderate running, or fast running). The intensity of activity reports a percentage of intensity of this particular activity as compared with the top performance intensity. Calculation methods are known in the state of the art, e.g., running 70% could mean to run at 70% of the Vo2Max (maximum effort) capability, which can be approximated by the following formula:

Vo2Max = Maximum recommended heart rate × 0.70

For calculation of the maximum recommended heart rate, see 5.25.

5.5 Activity time (enumeration)

This concept differs from a session or subsession in that this concept provides categorization and aggregation of the time spent in certain activities within the associated session or subsession. Typically, this concept is employed in general daily activity monitoring where daily activities are categorized by how much time in the session or subsession was spent in various activities such as sleeping, sitting, or walking.

5.6 Age (numeric)

Age is a setting typically entered manually by the user. The age setting might be used by an agent for derived calculations (e.g., calculation of maximum recommended heart rate; see 5.25).

5.7 Altitude (numeric)

Altitude represents a point of elevation, relative to sea level.

5.8 Altitude gain (numeric)

While ascent time and distance (see 5.10) capture the distance and time spent gaining altitude, the measurement of altitude gain depicts the cumulative height gained during ascents since the start of a session or subsession.

If in Figure 2 a person traveled a→b→c, then both the altitude gain and the altitude loss would be bd. These values are equal because the start and finish for the route of travel are on the same elevation. However, if a person traveled from a→b, then the altitude gain would be bd and the altitude loss would be zero.

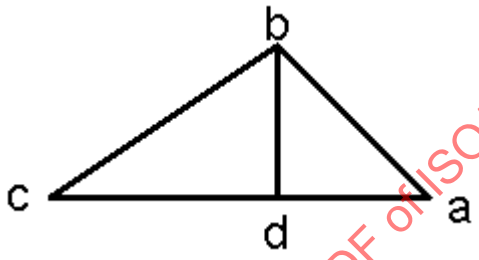

Figure 2—Distance and elevation profile

5.9 Altitude loss (numeric)

While descent time and distance (see 5.7) capture the distance and time spent losing altitude, the measurement of altitude loss depicts the cumulative height lost during descents since the start of a session or subsession.

If in Figure 2 a person traveled a→b→c, then both the altitude gain and the altitude loss would be bd. These values are equal because the start and finish for the route of travel are on the same elevation. However, if a person traveled from a→b, the altitude gain would be bd and the altitude loss would be zero.

5.10 Ascent time and distance

The ascent time records the period spent gaining elevation since the start of a session or subsession and may be used to determine a measure of work expended. The ascent distance records the respective distances covered during those periods.

If in Figure 2 a person traveled a→b→c, then the ascent distance would be ab and the descent distance would be bc.

5.11 Body height (numeric)

Body height is a setting typically entered manually by the user. The height setting might be used by an agent for derived calculations (e.g., calculation of body mass index).

5.12 Body weight (numeric)

Body weight is a setting typically entered manually by the user, although an agent may have the capability to measure this directly. The weight setting might be used by an agent for derived calculations (e.g., calculation of the energy expended during a jogging session).

5.13 Breathing rate (numeric)

The breathing rate can provide information on lung function in response to physical exertion. The breathing rate can either be calculated as the maximum, minimum, or mean values for a session or subsession or as an instantaneous value.

5.14 Cadence (numeric)

Cadence records the frequency of a repetitive action, such as the rate of revolution of the pedals of a bicycle or striding frequency of a runner or walker. Cadence is either recorded as the minimum, mean, or maximum values for a session or subsession or as an instantaneous value.

5.15 Calories ingested (numeric)

Calories ingested are an entry, either through manual means or through an agent having the capability to set it. This is the number of calories consumed or ingested by a person since the start of a session or subsession.

5.16 Carbohydrate calories ingested (numeric)

Carbohydrate calories ingested are an entry, either through manual means or through an agent having the capability to set it. This is the number of carbohydrate calories consumed or ingested by a person since the start of a session or subsession.

5.17 Descent time and distance (numeric)

The descent time records the period spent losing elevation since the start of a session or subsession and may be used to determine a measure of work expended. The descent distance records the respective distances covered during those periods.

If in Figure 2 a person traveled a→b→c, then the ascent distance would be ab and the descent distance would be bc.

5.18 Distance (numeric)

Distance defines the total distance covered since the start of a session and/or subsession. Distance may be specified as the actual distance such as meters or feet, or in more abstract concepts such as steps taken or flights of stairs climbed. In the latter case, the distance expressed in MDC_DIM_STEP is equivalent to a stride count measurement.

Using the distance and elevation profile shown in Figure 2 if a person were to travel a→b→c, the distance traveled would be ab + bc.

5.19 Energy expended (numeric)

This is the amount of energy expended since the start of a session or subsession.

5.20 Estimated weight loss (numeric)

The estimated weight loss approximates the weight loss since the start of a session and/or subsession. Weight loss is a common goal for cardiovascular exercise. It is typically calculated by step counters and activity monitors as a derivation from energy expended. The state of the art reports several methods of calculation based on energy expended and weight.

5.21 Heart rate (numeric)

Heart rates can be observed either as the maximum, minimum, or mean values for a session or subsession, or as an instantaneous value. The rate is a key indicator of physical exertion. In particular, the maximum observed heart rate is an important observation that might be used to calculate the VO2 of a user.

5.22 Incline (numeric)

This measurement represents the steepness of the incline being traveled either as a minimum, mean, or maximum value over a session or subsession or as an instantaneous value. A positive value means an incline and a negative one a decline. As such, the minimum incline gives the value of the steepest decline during the session or subsession.

5.23 Latitude (numeric)

This is the latitudinal (north/south) location of the person at a point in time.

5.24 Longitude (numeric)

This is the longitudinal (east/west) location of the person at a point in time.

5.25 Maximum recommended heart rate (numeric)

The maximum recommended heart rate is typically manually entered by the user (or the physician) or can be calculated. Its simplest estimation is given by the formula:

Maximum recommended heart rate = 220 – Age

The maximum recommended heart rate can be useful in providing context for the other values like the maximum, minimum, and mean observed heart rates achieved during an exercise session.

5.26 Proportional integral mode (PIM) (numeric)

PIM is defined for a session or subsession as the integral of the 3D variable with respect to one of its axes over the duration of the session or subsession. It is used in actigraphy to provide an activity measurement

for both sleep and activity periods. Figure 3 shows an example for the PIM for the *z* axis for 3D acceleration.

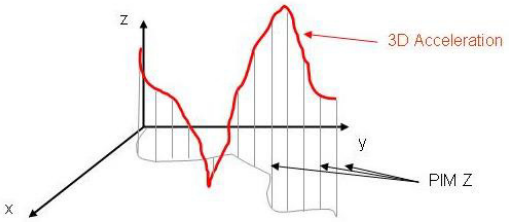

Figure 3—Proportional integral mode (monodimentional z)

Note that this PIM is not the one commonly defined by the IEEE in control systems as proportional integral mode.

5.27 Power (numeric)

Power is a measure of the work rate of a user. Power is measured either as a minimum, mean, and maximum value over a session or subsession or as an instantaneous value.

5.28 Program identifier (enumeration)

This measurement identifies the exercise program used by the person during a session or subsession.

5.29 Resistance (numeric)

This measurement represents either the minimum, mean, or maximum resistance employed over a session or subsession or the instantaneous resistance. This measurement applies primarily to machines that apply variable resistance to a person doing an exercise.

5.30 Root mean square (RMS) (numeric)

RMS is defined for a session or subsession as the root mean squared of the 3D variable with respect to one of its axes over the duration of the session or subsession.

5.31 Session (enumeration)

A session defines the envelope that contains all the measurements associated with an episode of activity/exercise. Each session defines its start date and time of the episode as well as the duration and the activity that the user engaged in during the episode.

5.32 Session-subsession-start-indicator (enumeration)

The session-subsession-start-indicator is used to mark the beginning of a continuously monitored session or subsession.

5.33 Slopes (numeric)

This is the number of slopes skied by a person since the start of the session or a subsession.

5.34 Speed (numeric)

Speed adds additional context to the work being done and is used to capture how fast the user moved across a distance (5.18). Speed is either reported as minimum, mean, or maximum speed for a session or subsession or as instantaneous speed.

5.35 Stride length (numeric)

This is a measurement of the distance covered in a single stride/step when walking or running. It is either captured as a minimum, mean, and maximum value over a session or subsession or as an instantaneous value.

5.36 Subsession (enumeration)

The subsession defines the envelope that contains all the measurements associated with a portion of the session. Each subsession defines its start date, start time, and duration; it also contains the activity that the user engaged in during the subsession.

5.37 Sustained physical activity threshold (numeric)

This setting represents the amount of time a person must be engaged in physical activity to be considered sustained physical activity, which is an important metric in determining a person's activity level.

5.38 Time above threshold (TAT) (numeric)

TAT is defined for a session or subsession as the total time that the input variable exceeds a given threshold value over the duration of the session or subsession. Figure 4 shows an example for the TAT for the *z* axis for 3D acceleration.

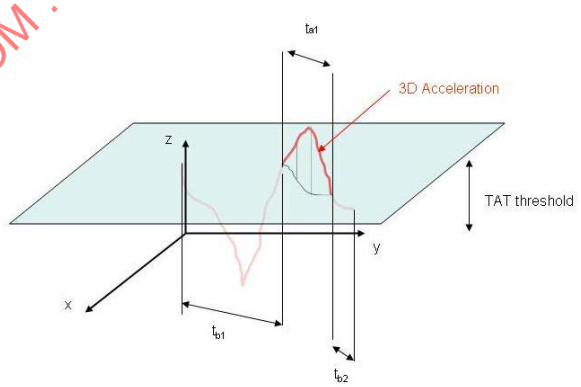

Figure 4—Time above threshold (monodimensional *z*)

5.39 TAT-threshold (numeric)

The TAT-threshold is the value applied in evaluating the corresponding the TAT value. The TAT-threshold may change between sessions or subsession; in which case, the TAT-threshold should be provided with every TAT value.

6. Cardiovascular fitness and activity monitor domain information model

6.1 Overview

This clause describes the domain information model of the cardiovascular fitness and activity monitor.

6.2 Class extensions

In this standard, no class extensions are defined with respect to IEEE Std 11073-20601a-2010.

6.3 Object instance diagram

The object instance diagram of the cardiovascular fitness and activity monitor domain information model, defined for the purposes of this standard, is shown in Figure 5.

The objects of the DIM, as shown in Figure 5, are described in 6.4 through 6.13. This includes the medical device system (MDS) object (see 6.4), the numeric objects (see 6.7), the RT-SA objects (see 6.8), the enumeration objects (see 6.9), the PM-store objects (see 6.10), and the scanner objects (see 6.11). See 6.12 for rules for extending the information model beyond elements as described in this standard. Each subclause that describes an object of the cardiovascular fitness and activity monitor contains the following information:

- The nomenclature code used to identify the class of the object. One example where this code is used is the configuration event, where the object class is reported for each object. This allows the manager to determine whether the class of the object being specified is a numeric, real-time sample array class, enumeration, scanner, or PM-store class.
- The attributes of the object. Each object has attributes that represent and convey information on the physical agent and its data sources. Each object has a handle attribute that identifies the object instance within an agent. Attribute values are accessed and modified using communication services such as GET and SET. Attributes types are defined using ASN.1. The ASN.1 definitions for new attribute types specific to this standard are in Annex B, and the ASN.1 definitions for existing attribute types referenced in this standard are in in IEEE Std 11073-20601a-2010.
- The methods available on the object.
- The potential events generated by the object. The data are sent to the manager using events.
- The available services such as getting or setting attributes.

The attributes for each class are defined in tables that specify the name of the attribute, its value, and its qualifier. The qualifiers mean: M — Attribute is Mandatory, C — Attribute is Conditional and depends on the condition stated in the Remark or Value column (if IEEE Std 11073-20601a-2010 is referenced, then it contains the conditions), R — Attribute is Recommended, NR — Attribute is Not Recommended, and O — Attribute is Optional. Mandatory attributes shall be implemented by an agent. Conditional attributes shall be implemented if the condition applies and may be implemented otherwise. Recommended attributes should be implemented by the agent.

Not recommended attributes should not be implemented by the agent. Optional attributes may be implemented by the agent. For attributes with qualifiers set to R or NR, underlying requirements stated in the Remark and Value column in IEEE Std 11073-20601a-2010 shall be followed.

The attributes can be either static, meaning that they shall remain unchanged after the configuration is agreed upon, or dynamic, meaning that the attribute may change at some point after configuration.

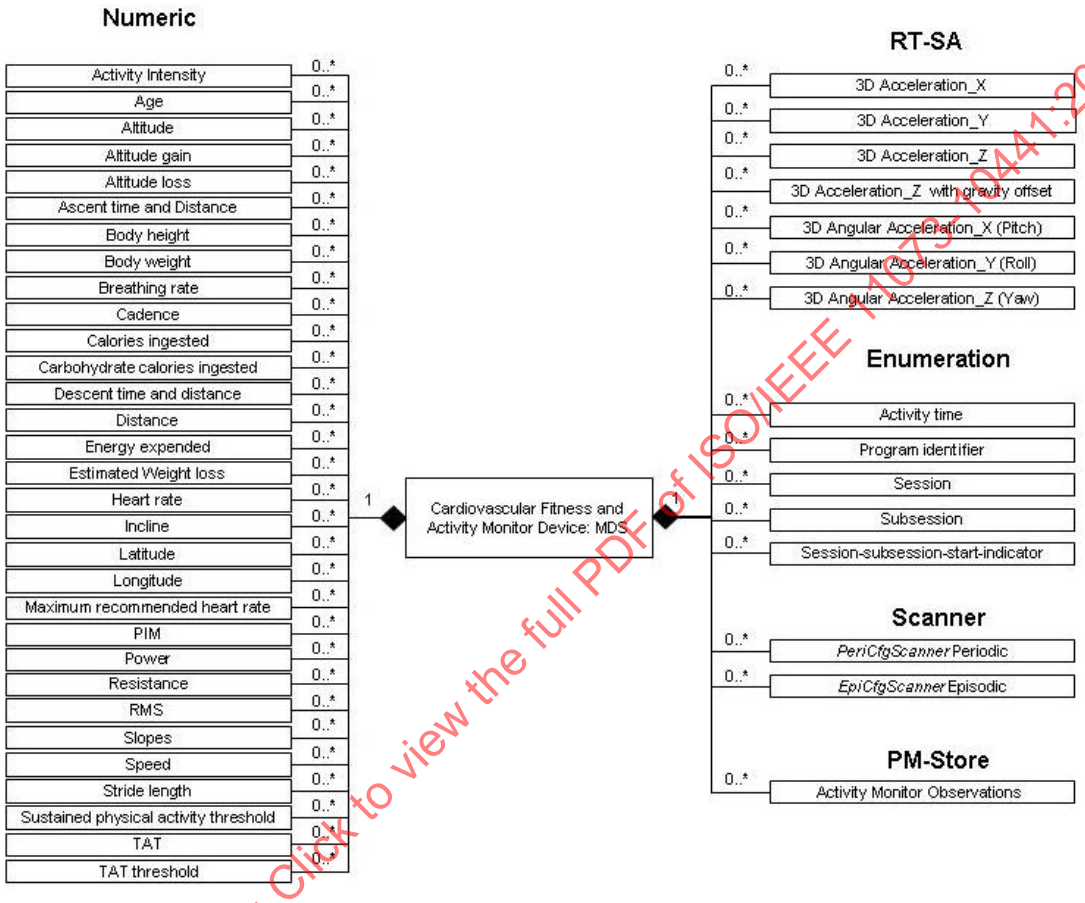

Figure 5—Object instance diagram

6.4 Types of configuration

6.4.1 General

As specified in IEEE Std 11073-20601a-2010, two styles of configuration are available. Subclauses 6.4.2 and 6.4.3 briefly introduce standard and extended configurations.

6.4.2 Standard configuration

Standard configurations are defined in the ISO/IEEE 11073-104zz specializations (such as this standard) and are assigned a well-known identifier (Dev-Configuration-Id). The usage of a standard configuration is negotiated at association time between the agent and the manager. If the manager recognizes and selects to operate using the configuration, then the agent can send measurements immediately. If the manager does not recognize the configuration, then the agent provides the configuration prior to transmitting measurement information. This standard does not support standard configurations.

6.4.3 Extended configuration

In extended configurations, the agent's configuration is not predefined in a standard. The agent determines which objects, attributes, and values that it wants to use in a configuration and assigns a configuration identifier. When the agent associates with a manager, it negotiates an acceptable configuration. Typically, the manager does not recognize the agent's configuration on the first connection, so the manager responds that the agent must send its configuration information as a configuration event report. If, however, the manager already understands the configuration, either because it was preloaded in some way or the agent had previously associated with the manager, then the manager responds that the configuration is known and no further configuration information needs to be sent.

6.5 Profiles

6.5.1 General

A profile further constrains the objects, services, and communication model of a specialization. By profiling the device specialization, the standard provides more guidance on the specific mandatory objects that shall be implemented, for that profile. This standard defines two profiles: step counter (see Clause 11) and activity monitor (see Clause 12). A cardiovascular fitness and activity monitor device may implement one of these profiles.

6.6 Medical device system object

6.6.1 MDS object attributes

Table 1 summarizes the attributes of the cardiovascular fitness and activity monitor MDS object. The nomenclature code to identify the MDS object class is MDC_MOC_VMS_MDS_SIMP.

Table 1—MDS object attributes

Attribute name	Value	Qual.
Handle	0	M
System-Type	Attribute not present. See IEEE Std 11073-20601a-2010.	C
System-Model	{"Manufacturer","Model"}.	M
System-Id	See IEEE Std 11073-20601a-2010.	M
Dev-Configuration-Id	Extended configs: 0x4000-0x7FFF.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Production-Specification	See IEEE Std 11073-20601a-2010.	O
Mds-Time-Info	See IEEE Std 11073-20601a-2010.	C
Date-and-Time	See IEEE Std 11073-20601a-2010.	C
Relative-Time	See IEEE Std 11073-20601a-2010.	C
HiRes-Relative-Time	See IEEE Std 11073-20601a-2010.	C
Base-Offset-Time-Stamp	See IEEE Std 11073-20601a-2010.	C
Date-and-Time-Adjustment	See IEEE Std 11073-20601a-2010.	C
Power-Status	*onBattery* or *onMains*.	R
Battery-Level	See IEEE Std 11073-20601a-2010.	R
Remaining-Battery-Time	See IEEE Std 11073-20601a-2010.	R
Reg-Cert-Data-List	See IEEE Std 11073-20601a-2010.	O
System-Type-Spec-List	{MDC_DEV_SPEC_PROFILE_HF_CARDIO, 1}. and Profile value: {MDC_DEV_SUB_SPEC_PROFILE_STEP_COUNTER, 1} or {MDC_DEV_SUB_SPEC_PROFILE_ACTIVITY, 1}	M
Confirm-Timeout	See IEEE Std 11073-20601a-2010.	O

In the response to a Get MDS object command, only implemented attributes and their corresponding values are returned.

See IEEE Std 11073-20601a-2010 for descriptive explanations of the individual attributes as well as for information on attribute ID and attribute type.

If an agent implements multiple ISO/IEEE 11073-104zz specializations, System-Type-Spec-List is a list of type/version pairs, each referencing the respective device specialization and version of that specialization. For a cardiovascular fitness and activity monitor agent, a specialization value of MDC_DEV_SPEC_PROFILE_HF_CARDIO shall be included in the System-Type-Spec-List attribute as shown in Table 1. Additionally, the value(s) for the supported profile(s) shall be included in the System-Type-Spec-List attribute.

The Dev-Configuration-Id attribute holds a locally unique 16-bit identifier that identifies the device configuration. For a cardiovascular fitness and activity monitor agent, this identifier is chosen in the range of extended-config-start to extended-config-end (see IEEE Std 11073-20601a-2010) as shown in Table 1. Since it is an extended configuration, the actual configuration associated with the Dev-Configuration-Id is globally unique only for a given System-Id (agent device).

The agent sends the Dev-Configuration-Id and System-Id during the Associating state (see 8.3) to identify its configuration for the duration of the association. If the manager already holds the configuration information relating to the Dev-Configuration-Id and System-Id pair, then it recognizes the Dev-Configuration-Id for that agent device. Then, the Configuration state (see 8.4) is skipped, and the agent and manager enter the Operating state. If the manager does not recognize the Dev-Configuration-Id for that System-Id, then the agent and manger enter the Configuring state.

If an agent implements multiple IEEE 11073-104zz specializations, then the System-Type-Spec-List will contain a list of type/version pairs each referencing the respective device specialization and version of that specialization in addition to the entry required for this specialization as noted in Table 1.

6.6.2 MDS object methods

Table 2 defines the methods (actions) of the cardiovascular fitness and activity monitor agent's MDS object. These methods are invoked using the Action service. In Table 2, the Subservice type name column defines the name of the method; the Mode column defines whether the method is invoked as an unconfirmed action (i.e., roiv-cmip-action from IEEE Std 11073-20601a-2010) or a confirmed action (i.e., roiv-cmip-confirmed-action); the Subservice type (action-type) column defines the nomenclature code to use in the action-type field of an action request and response (see IEEE Std 11073-20601a-2010); the Parameters (action-info-args) column defines the associated ASN.1 data structure (see IEEE Std 11073-20601a-2010 and ASN.1 definitions) to use in the action message for the action-info-args field of the request; and the Results (action-info-args) column defines the structure to use in the action-info-args of the response.

Table 2—MDS object methods

Service	Subservice type name	Mode	Subservice type (action-type)	Parameters (action-info-args)	Results (action-info-args)
ACTION	Set-Time	Confirmed	MDC_ACT_SET_TIME	SetTimeInvoke	—
	Set-Base-Offset-Time	Confirmed	MDC_ACT_SET_BO_TIME	SetBOTimeInvoke	—

Set-Time

This method allows the manager to set a real-time clock in the agent with the absolute time. The agent indicates whether the Set-Time command is valid using the mds-time-capab-set-clock bit in the Mds-Time-Info attribute (see IEEE Std 11073-20601a-2010).

If the agent supports the Absolute-Time-Stamp attribute, then this method shall be implemented.

Base-Offset-Time

This method allows the manager to set a real-time clock in the agent with the base time and offset. The agent indicates whether the Set-Base-Offset-Time command is valid using the mds-time-capab-set-clock bit in the Mds-Time-Info attribute (see IEEE Std 11073-20601a-2010).

If the agent supports the Base-Offset-Time-Stamp attribute, then this method shall be implemented.

An agent may support either absolute time or base time, but not both. The time option used is indicated by the agent in the Mds-Time-Info attribute.

Agents following this device specialization shall support the sending of any temporarily stored and real-time measurement data using the agent-initiated method of measurement data transmission. This requirement does not prevent the agent from supporting additional methods of measurement data transmission, but agents that choose to support these additional methods shall fall back to the agent-initiated method of measurement data transmission when associated with a manager that does not support these additional methods of data transmission. During the association procedure (see 8.3), DataReqModeCapab shall be set to the appropriate value for the event report style. Managers supporting this specialization are only required to support agent-initiated measurement transfers. Thus, implementation of the MDS-Data-Request method/action is not required in this standard and is not shown in Table 2.

6.6.3 MDS object events

Table 3 defines the events that can be sent by the cardiovascular fitness and activity monitor MDS object.

Table 3—MDS object events

Service	Subservice type name	Mode	Subservice type (event-type)	Parameters (event-info)	Results (event-reply-info)
EVENT REPORT	MDS-Configuration-Event	Confirmed	MDC_NOTI_CONFIG	ConfigReport	ConfigReportRsp
	MDS-Dynamic-Data-Update-Var	Confirmed	MDC_NOTI_SCAN_REPORT_VAR	ScanReportInfoVar	—
	MDS-Dynamic-Data-Update-Fixed	Confirmed	MDC_NOTI_SCAN_REPORT_FIXED	ScanReportInfoFixed	—
	MDS-Dynamic-Data-Update-MP-Var	Confirmed	MDC_NOTI_SCAN_REPORT_MP_VAR	ScanReportInfoMPVar	—
	MDS-Dynamic-Data-Update-MP-Fixed	Confirmed	MDC_NOTI_SCAN_REPORT_MP_FIXED	ScanReportInfoMPFixed	—

— **MDS-Configuration-Event:**
This event is sent by the agent during the configuring procedure if the manager does not already know the agent's configuration from past associations. The event provides static information about the supported measurement capabilities of the agent.

— **MDS-Dynamic-Data-Update-Var:**
This event provides dynamic measurement data from the agent. These data are reported using a generic attribute list variable format. The event is sent as an unsolicited message by the agent

(i.e., an agent-initiated measurement data transmission). See 8.5.3 for more information on unsolicited event reporting.

— **MDS-Dynamic-Data-Update-Fixed:**
This event provides dynamic measurement data from the agent. These data are reported in the fixed format defined by the Attribute-Value-Map attribute of the relevant metric objects. The event is sent as an unsolicited message by the agent (i.e., an agent-initiated measurement data transmission). See 8.5.3 for more information on unsolicited event reporting.

— **MDS-Dynamic-Data-Update-MP-Var:**
This is the same as MDS-Dynamic-Data-Update-Var but allows inclusion of data from multiple people.

— **MDS-Dynamic-Data-Update-MP-Fixed:**
This is the same as MDS-Dynamic-Data-Update-Fixed but allows inclusion of data from multiple people.

NOTE—IEEE Std 11073-20601a-2010 requires that managers support all of the MDS object events listed above.

6.6.4 Other MDS services

6.6.4.1 GET service

A cardiovascular fitness and activity monitor agent shall support the GET service as indicated by IEEE Std 11073-20601a-2010.

A cardiovascular fitness and activity monitor agent shall support the GET service, which is provided by the MDS object to retrieve the values of all implemented MDS object attributes. The GET service can be invoked as soon as the cardiovascular fitness and activity monitor agent receives the Association Response and moves to the Associating state, including the Operating and Configuring sub-states.

The manager may request the MDS object attributes of the Basic cardiovascular fitness and activity monitor agent; in which case, the manager shall send the “Remote Operation Invoke | Get” message (see roiv-cmip-get in IEEE Std 11073-20601a-2010) with the reserved MDS handle value of 0. The cardiovascular fitness and activity monitor agent shall report its MDS object attributes to the manager using the “Remote Operation Response | Get” message (see rors-cmip-get in IEEE Std 11073-20601a-2010). See Table 4 for a summary of the GET service including some message fields.

Table 4—Cardiovascular fitness and activity monitor MDS object GET service

Service	Subservice type name	Mode	Subservice type	Parameters	Results
GET	<na>	<implied confirmed>	<na>	GetArgumentSimple = (obj-handle = 0), attribute-id-list <*optional*>	GetResultSimple = (obj-handle = 0), attribute-list

See 8.5.2 for details on the procedure for getting the MDS object attributes.

6.6.4.2 SET service

The cardiovascular fitness and activity monitor specialization does not require an implementation to support the MDS object SET service.

6.7 Numeric objects

6.7.1 General

6.7.1.1 Definitions

The numeric objects listed in this subclause represent the numeric observations that can be produced by a cardiovascular fitness and activity monitor agent. The nomenclature code to identify a numeric object class is MDC_MOC_VMO_METRIC_NU. Each object specifies how each attribute is to be used, but there are some concepts that apply to each numeric in a general fashion that are described in 6.7.1.2 through 6.7.1.7.

6.7.1.2 Dependent attributes

Sometimes, the interpretation of one attribute value in an object depends on other attribute values in the same object. For example, Unit-Code and Unit-Label-String provide context for the observed values. Whenever a contextual attribute changes, the agent shall report these changes to the manager using an MDS object event (see 6.6.3) prior to reporting any of the dependent values.

6.7.1.3 Timestamps

All numeric object instances are associated with either a session or subsession object, defined in 6.9.2 and 6.9.5, respectively:

— In case of a session summary, only the session or subsession shall have a timestamp attribute.

— In case of a continuously monitoring session or subsession, session summary attributes are reported and in addition each numeric object instance sampled will carry its own timestamp attribute.

6.7.1.4 Source handle reference

It is possible for a session or subsession to have associated numeric objects that represent observations that span the entire session or subsession. Therefore, the Source-Handle-Reference attribute of the numeric object shall identify whether the numeric object instance is associated with either the session or the subsession object. If the numeric object is a session-level observation, then the Source-Handle-Reference shall be equal to the value of the handle of the session object. Likewise, if the numeric object represents a subsession-level observation, then the Source-Handle-Reference attribute shall be equal to the handle of the subsession object.

6.7.1.5 Methods

The objects listed in this subclause do not support any methods.

6.7.1.6 Events

The objects listed in this subclause do not support any events.

6.7.1.7 Services

The objects listed in this subclause do not support any services.

6.7.2 Activity intensity

Table 5 defines the attributes for the object that represents the activity intensity. This object may be supported by the agent.

Table 5—Activity intensity attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_ACTIVITY_INTENSITY	M
Supplemental-Types	This attribute denotes the type of measure performed. If Supplemental-Types is not present, then the measurement represented by this object is the instantaneous value. Otherwise, it might either be the mean, maximum, or minimum during the measurement period as defined by the associated session or subsession object. See IEEE Std 11073-20601a-2010. A device that conforms to this specialization shall take only one of the following values: MDC_HF_MEAN_NULL_INCLUDE MDC_HF_MEAN_NULL_EXCLUDE MDC_HF_MAX MDC_HF_MIN.	O
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_PERCENT.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a session or a subsession.	O

The observed value reported in this object is the percentage of maximal intensity effort expended. According to the Supplemental-Types, this value might either be the mean, maximum, or minimum during the measurement period as defined by the associated session or subsession object, or the instantaneous value in absence of Supplemental-Types. Only values between 0 and 100 shall be used.

6.7.3 Age

Table 6 defines the attributes for the object that represents age. This object may be supported by the agent.

Table 6—Age attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_AGE.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated | mss-cat-setting.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_YR.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	NR

The observed value reported in this object is the user's age at the time of the observation. Age is a setting typically entered manually by the user. Only non-negative whole numbers shall be used.

6.7.4 Altitude

Table 7 defines the attributes for the object that represents altitude. This object may be supported by the agent.

Table 7—Altitude attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_ALT.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_M or MDC_DIM_FOOT.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

The observed value reported in this object is the altitude measurement relative to sea level. Positive numbers indicate elevations greater than sea level, negative numbers indicate elevations lower than sea level, and zero is equal to sea level.

6.7.5 Altitude gain

Table 8 defines the attributes for the object that represents the sum of all altitude gained. This object may be supported by the agent.

Table 8—Altitude gain attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_ALT_GAIN.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_M or MDC_DIM_CENTI_M or MDC_DIM_INCH.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

The observed value reported in this object is the sum of all altitude gained since the start of the measurement period, as defined by the associated session or subsession object. Only non-negative values shall be used, with 0 indicating that no altitude was gained.

6.7.6 Altitude loss

Table 9 defines the attributes for the object that represents the sum of all altitude lost. This object may be supported by the agent.

Table 9—Altitude loss attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_ALT_LOSS.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_M or MDC_DIM_CENTI_M or MDC_DIM_INCH.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

The observed value reported in this object is the sum of all altitude lost since the start of the measurement period, as defined by the associated session or subsession object. Only non-negative values shall be used, with 0 indicating that no altitude was lost.

6.7.7 Ascent time and distance

Table 10 defines the attributes for the object that represents the ascent time and distance. This object may be supported by the agent.

Table 10—Ascent time and distance attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_ASC_TIME_DIST.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_M or MDC_DIM_CENTI_M or MDC_DIM_INCH or MDC_DIM_ STEP.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

The observed value reported in this object is the distance covered while gaining elevation since the start of the measurement period, as defined by the associated session or subsession object. Only non-negative numbers shall be used.

The amount of time spent gaining altitude is represented in the Measure-Active-Period attribute.

6.7.8 Body height

Table 11 defines the attributes for the object that represents height. This object may be supported by the agent.

Table 11—Body height attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_SCADA | MDC_LEN_BODY_ACTUAL.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated | mss-cat-setting	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_M or MDC_DIM_FOOT.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	NR

Body height is a setting typically entered manually by the user. Only non-negative values shall be used.

6.7.9 Body weight

Table 12 defines the attributes for the object that represents body weight. This object may be supported by the agent.

Table 12—Body weight attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_SCADA | MDC_MASS_BODY_ACTUAL.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_KILO_G or MDC_DIM_LB.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	NR

The setting value reported in this object is the user's body weight. Only non-negative values shall be used.

Weight is a setting typically entered manually by the user, although an agent may have the capability to set it. Weight setting might be used by an agent for derived calculations (e.g., calculation of the energy expended during a jogging session).

6.7.10 Breathing rate

Table 13 defines the attributes for the object that represents breathing rate. This object may be supported by the agent.

Table 13—Breathing rate attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_SCADA | MDC_RESP_RATE.	M
Supplemental-Types	This attribute denotes the type of measure performed. If Supplemental-Types is not present, the measurement represented by this object is the instantaneous value. Otherwise, it might either be the mean, maximum, or minimum during the measurement period as defined by the associated session or subsession object. See IEEE Std 11073-20601a-2010. A device that conforms to this specialization shall take only one of the following values: MDC_HF_MEAN_NULL_INCLUDE MDC_HF_MEAN_NULL_EXCLUDE MDC_HF_MAX MDC_HF_MIN.	O
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-upd-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are limited to MDC_DIM_RESP_PER_MIN.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a session or a subsession.	O

According to the Supplemental-Types, the observed value reported in this object is either the mean, maximum, or minimum breathing rate observed during the measurement period as defined by the associated session or subsession object or an instantaneous value in absence of Supplemental-Types. Only non-negative values shall be used.

6.7.11 Cadence

Table 14 defines the attributes for the object that represents cadence. This object may be supported by the agent.

Table 14—Cadence attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_CAD.	M
Supplemental-Types	This attribute denotes the type of measure performed. If Supplemental-Types is not present, then the measurement represented by this object is the instantaneous value. Otherwise, it might either be the mean, maximum, or minimum during the measurement period as defined by the associated session or subsession object. See IEEE Std 11073-20601a-2010. A device that conforms to this specialization shall take only one of the following values: MDC_HF_MEAN_NULL_INCLUDE MDC_HF_MEAN_NULL_EXCLUDE MDC_HF_MAX MDC_HF_MIN.	O
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010	O
Unit-Code	Valid values are MDC_DIM_RPM.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a session or a subsession.	O

According to the Supplemental-Types, the observed value reported in this object is either the mean, maximum, or minimum cadence achieved during the measurement period, as defined by the associated session or subsession object; or it is an instantaneous value in absence of Supplemental-Types. The values shall be limited to non-negative numbers.

6.7.12 Calories ingested

Table 15 defines the attributes for the object that represents the calories ingested. This object may be supported by the agent.

Table 15—Calories ingested attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_CAL_INGEST.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_NUTRI_CAL.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	NR

The observed value reported in this object is the amount of calories ingested/eaten since the start of the measurement period, as defined by the associated session or subsession object. Only non-negative values shall be used.

6.7.13 Carbohydrate calories ingested

Table 16 defines the attributes for the object that represent the carbohydrate calories ingested. This object may be supported by the agent.

Table 16—Carbohydrate calories ingested attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_CAL_INGEST_CARB.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_NUTRI_CAL.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	NR

The observed value reported in this object is the amount of carbohydrate calories ingested/eaten since the start of the measurement period, as defined by the associated session or subsession object. Only non-negative values shall be used.

6.7.14 Descent time and distance

Table 17 defines the attributes for the object that represents the descent time and distance. This object may be supported by the agent.

Table 17—Descent time and distance attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_DESC_TIME_DIST.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_M or MDC_DIM_CENTI_M or MDC_DIM_INCH or MDC_DIM_ STEP.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

The observed value reported in this object is the distance covered while losing elevation since the start of the measurement period, as defined by the associated session or subsession object. Only non-negative numbers shall be used.

The amount of time spent losing altitude is represented in the Measure-Active-Period attribute.

6.7.15 Distance

Table 18 defines the attributes for the object that represents distance. This object may be supported by the agent.

Table 18—Distance attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_DISTANCE.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_M or MDC_DIM_CENTI_M or MDC_DIM_INCH or MDC_DIM_ STEP.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

The observed value reported in this object is the distance covered since the start of the measurement period, as defined by the associated session or subsession object. Only non-negative numbers shall be used.

6.7.16 Energy expended

Table 19 defines the attributes for the object that represents the energy expended. This object may be supported by the agent.

Table 19—Energy expended attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_ENERGY.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are limited to MDC_DIM_CAL or MDC_DIM_JOULES.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C

Attribute name	Value	Qual.
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

The observed value reported in this object is the energy expended since the start of the measurement period, as defined by the associated session or subsession object. Only non-negative values shall be used.

6.7.17 Estimated weight loss

Table 20 defines the attributes for the object that represents the weight loss through a session or subsession. The weight loss is calculated as a derivation of the energy spent. This object may be supported by the agent.

Table 20—Estimated weight loss attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_WEIGHTLOSS.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-cat-manual | mss-cat-calculation.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	MDC_DIM_KILO_G or MDC_DIM_LB.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

The calculated value reported in this object is an estimation of the weight loss due to the energy expended observation value since the start of the measurement period, as defined by the associated session or subsession object. Only non-negative values shall be used. The algorithms for weight-loss calculation are known in the state of the art; their implementation is vendor dependent and should be defined as appropriate in the implementation conformance statements (ICS) subclause (10.4).

6.7.18 Heart rate

Table 21 defines the attributes for the object that represents heart rate. This object may be supported by the agent.

Table 21—Heart rate attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_HR.	M
Supplemental-Types	This attribute denotes the type of measure performed. If Supplemental-Types is not present, then the measurement represented by this object is the instantaneous value. Otherwise, it might either be the mean, maximum, or minimum during the measurement period as defined by the associated session or subsession object. See IEEE Std 11073-20601a-2010. A device that conforms to this specialization shall take only one of the following values: MDC_HF_MEAN_NULL_INCLUDE MDC_HF_MEAN_NULL_EXCLUDE MDC_HF_MAX MDC_HF_MIN.	O
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are limited to MDC_DIM_BEAT_PER_MIN.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

According to the Supplemental-Types, the observed value reported in this object is either the mean, maximum, or minimum heart rates achieved during the measurement period as defined by the associated session or subsession object or an instantaneous value in absence of Supplemental-Types. Only non-negative values shall be used.

6.7.19 Incline

Table 22 defines the attributes for the object that represents incline. This object may be supported by the agent.

Table 22—Incline attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_INCLINE.	M
Supplemental-Types	This attribute denotes the type of measure performed. If Supplemental-Types is not present, then the measurement represented by this object is the instantaneous value. Otherwise, it might either be the mean, maximum, or minimum during the measurement period as defined by the associated session or subsession object. See IEEE Std 11073-20601a-2010. A device that conforms to this specialization shall take only one of the following values: MDC_HF_MEAN_NULL_INCLUDE MDC_HF_MEAN_NULL_EXCLUDE MDC_HF_MAX MDC_HF_MIN.	O
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_PERCENT or MDC_DIM_ANG_DEG.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a session or a subsession.	O

According to the Supplemental-Types, the observed value reported in this object is either the mean, maximum, or minimum inclines achieved during the measurement period as defined by the associated session or subsession object or an instantaneous value in absence of Supplemental-Types. Positive values represent an incline, and negative values represent a decline.

6.7.20 Latitude

Table 23 defines the attributes for the object that represents latitudinal location. This object may be supported by the agent.

Table 23—Latitude attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_LATITUDE.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R

Attribute name	Value	Qual.
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_ANG_DEG.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

The observed value reported in this object is the latitudinal location. The values shall be limited to –180 to 180. Positive values are used for north latitude, whereas negative numbers are used for south latitude with the equator serving as zero latitude.

6.7.21 Longitude

Table 24 defines the attributes for the object that represents longitudinal location. This object may be supported by the agent.

Table 24—Longitude attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_LONGITUDE.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_ANG_DEG.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

The observed value reported in this object is the longitudinal location. The values shall be limited to –180 to 180. Positive values are used for east longitude, whereas negative numbers are used for west longitude with the Prime Meridian serving as zero longitude.

6.7.22 Maximum recommended heart rate

Table 25 defines the attributes for the object that represents the maximum recommended heart rate. This value is normally set by the user or by a program. This object may be supported by the agent.

Table 25—Maximum recommended heart rate attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_HR_MAX_USER.	M
Metric-Spec-Small	mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated | mss-cat-manual | mss-cat-setting | mss-cat-calculation.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	X
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_BEAT_PER_MIN.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	NR

The maximum recommended heart rate is typically manually entered by the user (or the physician) or can be calculated (see 5.25)

The maximum recommended heart rate might be used in sports equipment to estimate effort intensity zones.

6.7.23 PIM

Table 26 summarizes the attributes of the PIM numeric object. The nomenclature code to identify the numeric class is MDC_MOC_VMO_METRIC_NU. The PIM numeric object is a 3D vector that may be supported by an activity monitor agent.

Table 26—PIM numeric object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_HF | MDC_HF_PIM }.	M
Supplemental-Types	See IEEE Std 11073-20601a-2010.	NR
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-msmt-aperiodic, mss-acc-agent-initiated.	M
Metric-Structure-Small	{ms-struct-compound-fix,3}.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	R
Metric-Id	MDC_HF_PIM_X, MDC_HF_PIM_Y, MDC_HF_PIM_Z.	C
Metric-Id-List	See IEEE Std 11073-20601a-2010.	NR
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	C
Unit-Code	See IEEE Std 11073-20601a-2010. The value of this attribute depends on Handle value of the associated object.	M
Attribute-Value-Map	MDC_ATTR_NU_VAL_OBS_SIMP.	M
Source-Handle-Reference	The value of this attribute shall be set to the Handle value of the associated object. By default, this handle value is set to the associated 3D Acceleration object.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a session or a subsession.	O
Compound-Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Compound-Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Compound-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	R

The observed value reported in the PIM object is calculated for each of the three dimensions since the start of the measurement period, as defined by the associated session or subsession object. Only non-negative numbers shall be used.

The PIM numeric object does not support any methods, events, or other services.

6.7.24 Power

Table 27 defines the attributes for the object that represents power. This object may be supported by the agent.

Table 27—Power attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_POWER.	M
Supplemental-Types	This attribute denotes the type of measure performed. If Supplemental-Types is not present, then the measurement represented by this object is the instantaneous value. Otherwise, it might either be the mean, maximum, or minimum during the measurement period as defined by the associated session or subsession object. See IEEE Std 11073-20601a-2010. A device that conforms to this specialization shall take only one of the following values: MDC_HF_MEAN_NULL_INCLUDE MDC_HF_MEAN_NULL_EXCLUDE MDC_HF_MAX MDC_HF_MIN.	O
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are limited to MDC_DIM_WATT.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

According to the Supplemental-Types, the observed value reported in this object is either the mean, maximum, or minimum power achieved during the measurement period as defined by the associated session or subsession object or an instantaneous value in absence of Supplemental-Types. Only non-negative values shall be used.

6.7.25 Resistance

Table 28 defines the attributes for the object that represents resistance. This object may be supported by the agent. The resistance value is machine specific.

Table 28—Resistance attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_RESIST.	M
Supplemental-Types	This attribute denotes the type of measure performed. If Supplemental-Types is not present, then the measurement represented by this object is the instantaneous value. Otherwise, it might either be the mean, maximum, or minimum during the measurement period as defined by the associated session or subsession object. See IEEE Std 11073-20601a-2010. A device that conforms to this specialization shall take only one of the following values: MDC_HF_MEAN_NULL_INCLUDE MDC_HF_MEAN_NULL_EXCLUDE MDC_HF_MAX MDC_HF_MIN.	O
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	See IEEE Std 11073-20601a-2010. The resistance value is specific to each machine; it does not support standardized unit-codes.	NR
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

According to the Supplemental-Types, the observed value reported in this object is either the mean, maximum, or minimum resistance achieved during the measurement period as defined by the associated session or subsession object or an instantaneous value in absence of Supplemental-Types. Only non-negative values shall be used.

6.7.26 RMS

Table 29 summarizes the attributes of the RMS numeric object. The nomenclature code to identify the numeric class is MDC_MOC_VMO_METRIC_NU. The RMS numeric object may be supported by an activity monitor agent.

Table 29—RMS numeric object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_HF | MDC_HF_RMS}.	M
Supplemental-Types	See IEEE Std 11073-20601a-2010.	NR
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-msmt-aperiodic, mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	R
Metric-Id	See IEEE Std 11073-20601a-2010.	C
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	C
Unit-Code	See IEEE Std 11073-20601a-2010. The value of this attribute depends on the Handle value of the associated object.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	See IEEE Std 11073-20601a-2010. The value of this attribute shall be set to the Handle value of the associated object. By default, this handle value is set to the associated 3D Acceleration object.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	R

The observed value reported in this object is the RMS value of a 3D vector since the start of the measurement period, as defined by the associated session or subsession object. Examples of applications are RMS-Acceleration and RMS-PIM measuring the changing component of the acceleration vector length or, respectively, to the PIM indicating the intensity of activities. Only non-negative numbers shall be used.

The RMS numeric object does not support any methods, events, or other services.

6.7.27 Slopes

Table 30 defines the attributes for the object that represents the slopes skied. This object may be supported by the agent.

Table 30—Slopes attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_SLOPES.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_DIMLESS.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

The observed value reported in this object is the number of slopes skied since the start of the measurement period, as defined by the associated session or subsession object. The values shall be limited to non-negative numbers.

6.7.28 Speed

Table 31 defines the attributes for the object that represents speed. This object may be supported by the agent.

Table 31—Speed attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_SPEED.	M
Supplemental-Types	This attribute denotes the type of measure performed. If Supplemental-Types is not present, then the measurement represented by this object is the instantaneous value. Otherwise, it might either be the mean, maximum, or minimum during the measurement period as defined by the associated session or subsession object. See IEEE Std 11073-20601a-2010. A device that conforms to this specialization shall take only one of the following values: MDC_HF_MEAN_NULL_INCLUDE MDC_HF_MEAN_NULL_EXCLUDE MDC_HF_MAX MDC_HF_MIN.	O
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O

Attribute name	Value	Qual.
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_M_PER_SEC or MDC_DIM_CENTI_M_PER_MIN or MDC_DIM_INCH_PER_MIN or MDC_DIM_STEP_PER_MIN.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a sample-period-session.	O

According to the Supplemental-Types, the observed value reported in this object is either the mean, maximum, or minimum speed achieved during the measurement period as defined by the associated session or subsession object or an instantaneous value in absence of Supplemental-Types. Only non-negative values shall be used.

6.7.29 Stride length

Table 32 defines the attributes for the object that represents stride length. This object may be supported by the agent.

Table 32—Stride length attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_STRIDE.	M
Supplemental-Types	This attribute denotes the type of measure performed. If Supplemental-Types is not present, then the measurement represented by this object is the instantaneous value. Otherwise, it might either be the mean, maximum, or minimum during the measurement period as defined by the associated session or subsession object. See IEEE Std 11073-20601a-2010. A device that conforms to this specialization shall take only one of the following values: MDC_HF_MEAN_NULL_INCLUDE MDC_HF_MEAN_NULL_EXCLUDE MDC_HF_MAX MDC_HF_MIN.	O
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are limited to MDC_DIM_M or MDC_DIM_INCH.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C

Attribute name	Value	Qual.
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a session or a subsession.	O

According to the Supplemental-Types, the observed value reported in this object is either the mean, maximum, or minimum stride length achieved during the measurement period as defined by the associated session or subsession object or an instantaneous value in absence of Supplemental-Types. Only non-negative values shall be used.

6.7.30 Sustained phys activity threshold

Table 33 defines the attributes for the object that represents the sustained physical activity threshold. This object may be supported by the agent.

Table 33—Sustained physical activity threshold attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_SUST_PA_THRESHOLD.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	Valid values are MDC_DIM_MIN or MDC_DIM_SEC.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	NR

The observed value reported in this object is the amount of time that must be spent in continuous physical activity to be considered a period of sustained physical activity. Only non-negative values shall be used.

6.7.31 TAT

Table 34 summarizes the attributes of the TAT numeric object. The nomenclature code to identify the numeric class is MDC_MOC_VMO_METRIC_NU. The TAT numeric object may be supported by an activity monitor agent.

Table 34—TAT numeric object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_HF | MDC_HF_TAT}.	M
Supplemental-Types	See IEEE Std 11073-20601a-2010.	NR
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-udp-aperiodic, mss-msmt-aperiodic, mss-acc-agent-initiated, mss-cat-calculation.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	R
Metric-Id	See IEEE Std 11073-20601a-2010.	C
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	C
Unit-Code	MDC_DIM_PERTHOUSAND.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	The value of this attribute shall be set to the Handle value of the associated object. By default, this handle value is set to the associated 3D Acceleration object.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Measure-Active-Period	See IEEE Std 11073-20601a-2010. By default, the measuring period is a session or a subsession.	O
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Compound-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	R

The observed value reported in the TAT object is observed since the start of the measurement period, as defined by the associated session or subsession object. Only non-negative numbers shall be used.

The TAT numeric object does not support any methods, events, or other services.

6.7.32 TAT-threshold

Table 35 defines the attributes for the object that represents TAT-threshold. This object may be supported by the agent.

Table 35—TAT-threshold attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_SCADA | MDC_HF_TAT_THRESHOLD.	M
Metric-Spec-Small	mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-cat-manual | mss-cat-setting.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	R
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	See IEEE Std 11073-20601a-2010. The value of this attribute depends on the unit-code of the associated TAT object.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	O
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	NR

TAT-threshold is a setting either entered manually or programmatically. Only non-negative values shall be used.

6.8 Real-time sample array objects

When supporting real-time sample array objects, this standard shall support the periodic scanner objects collecting them.

6.8.1 3D Acceleration X

A representation of the 3D acceleration wave may be transmitted as a series of samples.

Table 36 defines the attributes of the 3D Acceleration X RT-SA object. This object is optional for this standard. The nomenclature code to identify the RT-SA object class is MDC_MOC_VMO_METRIC_SA_RT.

Table 36—3D Acceleration X object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{ MDC_PART_PHD_HF | MDC_HF_3D_ACC_X }.	M
Supplemental-Types	See IEEE Std 11073-20601a-2010.	NR
Metric-Spec-Small	mss-acc-agent-initiated.	M
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Unit-Code	MDC_DIM_M_PER_SEC_SQ or MDC_DIM_CENTI_M_PER_SEC_SQ.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Sample-Period	See IEEE Std 11073-20601a-2010.	M
Simple-Sa-Observed-Value	See IEEE Std 11073-20601a-2010.	M
Scale-and-Range-Specification	See IEEE Std 11073-20601a-2010.	M
Sa-Specification	See IEEE Std 11073-20601a-2010.	M

NOTE—See 6.3 for a description of the qualifiers.

6.8.2 3D Acceleration Y

A representation of the 3D acceleration wave may be transmitted as a series of samples.

Table 37 defines the attributes of the 3D Acceleration X RT-SA object. This object is optional for this standard. The nomenclature code to identify the RT-SA object class is MDC_MOC_VMO_METRIC_SA_RT.

Table 37—3D Acceleration Y object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{ MDC_PART_PHD_HF | MDC_HF_3D_ACC_Y }.	M
Supplemental-Types	See IEEE Std 11073-20601a-2010.	NR
Metric-Spec-Small	mss-acc-agent-initiated.	M
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Unit-Code	MDC_DIM_M_PER_SEC_SQ or MDC_DIM_CENTI_M_PER_SEC_SQ.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Sample-Period	See IEEE Std 11073-20601a-2010.	M
Simple-Sa-Observed-Value	See IEEE Std 11073-20601a-2010.	M
Scale-and-Range-Specification	See IEEE Std 11073-20601a-2010.	M
Sa-Specification	See IEEE Std 11073-20601a-2010.	M

NOTE—See 6.3 for a description of the qualifiers.

6.8.3 3D Acceleration Z

A representation of the 3D acceleration wave may be transmitted as a series of samples.

Table 38 defines the attributes of the 3D Acceleration Z RT-SA object. This object is optional for this standard. The nomenclature code to identify the RT-SA object class is MDC_MOC_VMO_METRIC_SA_RT.

Table 38—3D Acceleration Z object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{ MDC_PART_PHD_HF | MDC_HF_3D_ACC_Z }.	M
Supplemental-Types	See IEEE Std 11073-20601a-2010.	NR
Metric-Spec-Small	mss-acc-agent-initiated.	M
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Unit-Code	MDC_DIM_M_PER_SEC_SQ or MDC_DIM_CENTI_M_PER_SEC_SQ.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Sample-Period	See IEEE Std 11073-20601a-2010.	M
Simple-Sa-Observed-Value	See IEEE Std 11073-20601a-2010.	M
Scale-and-Range-Specification	See IEEE Std 11073-20601a-2010.	M
Sa-Specification	See IEEE Std 11073-20601a-2010.	M

NOTE—See 6.3 for a description of the qualifiers.

6.8.4 3D Acceleration Z-with-gravity-offset

A representation of the 3D acceleration wave may be transmitted as a series of samples.

Table 39 defines the attributes of the 3D Acceleration Z-with-gravity-offset RT-SA object. This object is optional for this standard. The nomenclature code to identify the RT-SA object class is MDC_MOC_VMO_METRIC_SA_RT.

Table 39—3D Acceleration Z-with-gravity-offset object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{ MDC_PART_PHD_HF | MDC_HF_3D_ACC_Z_G_OFFSET }.	M
Supplemental-Types	See IEEE Std 11073-20601a-2010.	NR
Metric-Spec-Small	mss-acc-agent-initiated.	M
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Unit-Code	MDC_DIM_M_PER_SEC_SQ or MDC_DIM_CENTI_M_PER_SEC_SQ.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C

Attribute name	Value	Qual.
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Sample-Period	See IEEE Std 11073-20601a-2010.	M
Simple-Sa-Observed-Value	See IEEE Std 11073-20601a-2010.	M
Scale-and-Range-Specification	See IEEE Std 11073-20601a-2010.	M
Sa-Specification	See IEEE Std 11073-20601a-2010.	M

NOTE—See 6.3 for a description of the qualifiers.

6.8.5 3D Angular acceleration X (pitch)

A representation of the 3D angular acceleration wave may be transmitted as a series of samples.

Table 40 defines the attributes of the 3D Angular acceleration X (pitch) RT-SA object. This object is optional for this standard. The nomenclature code to identify the RT-SA object class is MDC_MOC_VMO_METRIC_SA_RT.

Table 40—3D Angular acceleration X (pitch) object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{ MDC_PART_PHD_HF | MDC_HF_3D_ANG_ACC_X }.	M
Supplemental-Types	See IEEE Std 11073-20601a-2010.	NR
Metric-Spec-Small	mss-acc-agent-initiated.	M
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	M
Unit-Code	MDC_DIM_ANG_RAD_PER_SEC_SQ or MDC_DIM_ANG_DEG_PER_SEC_SQ.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Sample-Period	See IEEE Std 11073-20601a-2010.	M
Simple-Sa-Observed-Value	See IEEE Std 11073-20601a-2010.	M
Scale-and-Range-Specification	See IEEE Std 11073-20601a-2010.	M
Sa-Specification	See IEEE Std 11073-20601a-2010.	M

NOTE—See 6.3 for a description of the qualifiers.

6.8.6 3D Angular acceleration Y (roll)

A representation of the 3D angular acceleration wave may be transmitted as a series of samples.

Table 41 defines the attributes of the 3D angular acceleration Y (roll) RT-SA object. This object is optional for this standard. The nomenclature code to identify the RT-SA object class is MDC_MOC_VMO_METRIC_SA_RT.

Table 41—3D Angular acceleration Y (roll) object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{ MDC_PART_PHD_HF | MDC_HF_3D_ANG_ACC_Y }.	M
Supplemental-Types	See IEEE Std 11073-20601a-2010.	NR
Metric-Spec-Small	mss-acc-agent-initiated.	M
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	M
Unit-Code	MDC_DIM_ANG_RAD_PER_SEC_SQ or MDC_DIM_ANG_DEG_PER_SEC_SQ.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Sample-Period	See IEEE Std 11073-20601a-2010.	M
Simple-Sa-Observed-Value	See IEEE Std 11073-20601a-2010.	M
Scale-and-Range-Specification	See IEEE Std 11073-20601a-2010.	M
Sa-Specification	See IEEE Std 11073-20601a-2010.	M

NOTE—See 6.3 for a description of the qualifiers.

6.8.7 3D Angular acceleration Z (yaw)

A representation of the 3D angular acceleration wave may be transmitted as a series of samples.

Table 42 defines the attributes of the 3D angular acceleration Z (yaw) RT-SA object. This object is optional for this standard. The nomenclature code to identify the RT-SA object class is MDC_MOC_VMO_METRIC_SA_RT.

Table 42—3D Angular acceleration Z (yaw) object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{ MDC_PART_PHD_HF | MDC_HF_3D_ANG_ACC_Z }.	M
Supplemental-Types	See IEEE Std 11073-20601a-2010.	NR
Metric-Spec-Small	mss-acc-agent-initiated.	M
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	M
Unit-Code	MDC_DIM_ANG_RAD_PER_SEC_SQ or MDC_DIM_ANG_DEG_PER_SEC_SQ.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Sample-Period	See IEEE Std 11073-20601a-2010.	M
Simple-Sa-Observed-Value	See IEEE Std 11073-20601a-2010.	M
Scale-and-Range-Specification	See IEEE Std 11073-20601a-2010.	M
Sa-Specification	See IEEE Std 11073-20601a-2010.	M

NOTE—See 6.3 for a description of the qualifiers.

6.9 Enumeration objects

6.9.1 General

The enumeration objects listed in this subclause represent the enumeration observations that can be produced by a cardiovascular fitness and activity monitor agent. The nomenclature code to identify an enumeration object class is MDC_MOC_VMO_METRIC_ENUM. Each object specifies how each of the attributes should be used, but there are come concepts that apply to each enumeration in a general fashion that are described in this subclause.

6.9.1.1 Methods

The objects listed in this subclause do not support any methods.

6.9.1.2 Events

The objects listed in this subclause do not support any events.

6.9.1.3 Services

The objects listed in this subclause do not support any services.

6.9.2 Activity time

Table 43 defines the attributes for the object that represents the cumulative time spent engaged in a particular activity. This object may be supported by the agent.

Table 43—Activity time attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_ACTIVITY_TIME.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	See IEEE Std 11073-20601a-2010.	NR
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	NR
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	M
Enum-Observed-Value-Simple-Oid	Valid values are shown in Table 44.	M
Enum-Observed-Value-Simple-Str	See IEEE Std 11073-20601a-2010.	NR
Enum-Observed-Value	See IEEE Std 11073-20601a-2010.	NR
Enum-Observed-Value-Partition	See IEEE Std 11073-20601a-2010.	O

The purpose of this object is to identify the cumulative amount of time spent engaged in a given activity. This object is associated with a session or subsession object; as such, its Source-Handle-Reference attribute shall be equal to the handle of either a session or a subsession object, and its timestamp shall also be equal to the timestamp of the appropriate containing object.

The activity being engaged in is defined in the Enum-Observed-Value-Simple-Oid attribute. If an acceptable, existing nomenclature term is not available in Table 44, then MDC_DIM_ACT_UNKNOWN shall be used along with appropriate clarifying text in the Label-String attribute. Otherwise, the Label-String attribute may be used for any further clarification of the activity being represented by the object.

The cumulative amount of time spent engaged in the identified activity shall be specified in the Measure-Active-Period attribute.

Table 44—Enum observed values

#define MDC_HF_ACT_AMB	1000	/*	*/
#define MDC_HF_ACT_REST	1001	/*	*/
#define MDC_HF_ACT_MOTOR	1002	/*	*/
#define MDC_HF_ACT_LYING	1003	/*	*/
#define MDC_HF_ACT_SLEEP	1004	/*	*/
#define MDC_HF_ACT_PHYS	1005	/*	*/
#define MDC_HF_ACT_SUS_PHYS	1006	/*	*/
#define MDC_HF_ACT_UNKNOWN	1007	/*	*/
#define MDC_HF_ACT_MULTIPLE	1008	/*	*/
#define MDC_HF_ACT_MONITOR	1009	/*	*/
#define MDC_HF_ACT_SKI	1010	/*	*/

#define MDC_HF_ACT_RUN	1011	/*	*/
#define MDC_HF_ACT_BIKE	1012	/*	*/
#define MDC_HF_ACT_STAIR	1013	/*	*/
#define MDC_HF_ACT_ROW	1014	/*	*/
#define MDC_HF_ACT_HOME	1015	/*	*/
#define MDC_HF_ACT_WORK	1016	/*	*/
#define MDC_HF_ACT_WALK	1017	/*	*/
#define MDC_HF_ACT_EXERCISE_BIKE	1018	/*	*/
#define MDC_HF_ACT_GOLF	1019	/*	*/
#define MDC_HF_ACT_HIKE	1020	/*	*/
#define MDC_HF_ACT_SWIM	1021	/*	*/
#define MDC_HF_ACT_AEROBICS	1022	/*	*/
#define MDC_HF_ACT_DUMBBELL	1023	/*	*/
#define MDC_HF_ACT_WEIGHT	1024	/*	*/
#define MDC_HF_ACT_BAND	1025	/*	*/
#define MDC_HF_ACT_STRETCH	1026	/*	*/
#define MDC_HF_ACT_YOGA	1027	/*	*/
#define MDC_HF_ACT_WATER_WALK	1028	/*	*/

6.9.3 Program identifier

Table 45 defines the attributes for the object that represents an identifier of an exercise program that was used. This object may be supported by the agent.

Table 45—Program identifier attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_PROGRAM_ID.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	See IEEE Std 11073-20601a-2010.	NR
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	NR
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	O
Enum-Observed-Value-Simple-Str	See IEEE Std 11073-20601a-2010.	M
Enum-Observed-Value-Partition	See IEEE Std 11073-20601a-2010.	O

The purpose of this object is to identify the exercise program used during an exercise period. This object is associated with a session or subsession object; as such, its Source-Handle-Reference attribute shall be equal to the handle of either a session or a subsession object, and its timestamp shall also be equal to the timestamp of the appropriate containing object.

The program identifier is defined as a string in the Enum-Observed-Value-Simple-Str attribute. The value placed in this attribute is free text and is not constrained by any nomenclature. The byte length of the string shall be even, as defined in IEEE Std 11073-20601a-2010.

6.9.4 Session

Table 46 defines the attributes for the object that represents a session. The agent may include one instance of this object for each measurement period reported.

Table 46—Session attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_SESSION.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	See IEEE Std 11073-20601a-2010.	NR
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	NR
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	M
Enum-Observed-Value-Simple-Oid	Valid values are shown in Table 44.	M
Enum-Observed-Value-Partition	See IEEE Std 11073-20601a-2010.	O

The purpose of this object is to define the activity or exercise at a high level by specifying the activity, the date and time of the activity, and how much time was spent in the activity. This object defines the context for all the objects associated with it.

Session Summary

The session timestamp corresponds to the beginning of the session the total duration of the activity reported by the session shall be specified in the Measure-Active-Period attribute. The activity being engaged in is defined in the Enum-Observed-Value-Simple-Oid attribute. If an acceptable, existing nomenclature term is not available, MDC_HF_ACT_UNKNOWN shall be used along with appropriate clarifying text in the Label-String attribute. Otherwise, the Label-String attribute may be used for any further clarification of the activity being represented by the object.

If there are multiple subsessions associated with this object and the subsessions specify more than one activity, then the Enum-Observed-Value-Simple-Oid attribute shall be set to MDC_HF_ACT_MULTIPLE.

All subsessions that are contained by the session shall have a timestamp that falls within the time span that begins with the session's timestamp and lasts for the session's Measure-Active-Period attribute. Furthermore, the sum of all contained subsession Measure-Active-Period attributes shall be equal to the Measure-Active-Period attribute of the containing session and the time spans defined by the subsessions shall not overlap (i.e., one subsession fails to end prior to the beginning of the next subsession).

Metrics that represent observations for the session as a whole shall have a timestamp equal to the associated session object's timestamp. Such metric objects shall also specify the handle of the session object in the Metric's Source-Handle-Reference attribute.

Continuous Monitoring Session

The presence of a session-subsession-start-indicator object defines a continuous monitoring session where every numeric object reported during the session will carry its own timestamp attribute.

6.9.5 Subsession

Table 47 defines the attributes for the object that represents a subsession. The agent may include zero or more of these objects.

Table 47—Subsession attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_SUBSESSION.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010.	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	See IEEE Std 11073-20601a-2010.	NR
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	NR
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	M
Enum-Observed-Value-Simple-Oid	Valid values are shown in Table 44.	M
Enum-Observed-Value-Partition	See IEEE Std 11073-20601a-2010.	O

The purpose of this object is to define the activity or exercise for a subset of an associated session by specifying the activity, when the activity was started, and how much time was spent in the activity. This object defines the context for all the objects associated with it.

Subsession Summary

The subsession timestamp corresponds to the beginning of the subsession; the total duration of the activity reported by the subsession shall be specified in the Measure-Active-Period attribute. The timestamp attribute of the subsession shall fall within the time span specified by the session to which it is associated. The activity being engaged in is defined in the Enum-Observed-Value-Simple-Oid attribute. If an acceptable, existing nomenclature term is not available, then MDC_HF_ACT_UNKNOWN shall be used along with appropriate clarifying text in the Label-String attribute. Otherwise, the Label-String attribute may be used for any further clarification of the activity being represented by the object.

Metrics that represent observations for the subsession shall have a timestamp equal to the associated subsession object's timestamp. Such metric objects shall also specify the handle of the subsession object in the metric's Source-Handle-Reference attribute.

Continuous Monitoring Subsession

The presence of a session-subsession-start-indicator object defines a continuous monitoring subsession where every numeric object reported during the subsession will carry its own timestamp attribute.

6.9.6 Session-subsession-start-indicator

Table 48 defines the attributes for the object that represents an identifier of when a continuous monitoring session or subsession begins. This object may be supported by the agent.

Table 48—Session-subsession-start-indicator

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	MDC_PART_PHD_HF | MDC_HF_STRT.	M
Metric-Spec-Small	mss-avail-intermittent | mss-avail-stored-data | mss-updt-aperiodic | mss-msmt-aperiodic | mss-acc-agent-initiated.	M
Measurement-Status	See IEEE Std 11073-20601a-2010.	O
Metric-Id	See IEEE Std 11073-20601a-2010	O
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	O
Unit-Code	See IEEE Std 11073-20601a-2010	NR
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	Contains the handle of the session or subsession it is associated with. See IEEE Std 11073-20601a-2010.	M
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See 6.7.1.3.	C
Relative-Time-Stamp	See 6.7.1.3.	C
HiRes-Time-Stamp	See 6.7.1.3.	C
Base-Offset-Time-Stamp	See 6.7.1.3.	C
Enum-Observed-Value-Simple-Oid	Valid values are shown in Table 44.	M
Enum-Observed-Value	See IEEE Std 11073-20601a-2010.	NR
Enum-Observed-Value-Partition	See IEEE Std 11073-20601a-2010.	O
Enum-Observed-Value-Simple-Str	See IEEE Std 11073-20601a-2010.	NR
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	NR

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static, dynamic, or observational.

This object marks the beginning of a continuous monitoring session or subsession and provides the beginning timestamp.

An agent using continuous monitoring shall report one and only one sessions-subsession-start-indicator for a given session or subsession.

6.10 PM-store objects

6.10.1 General

Several use cases illustrate that a cardiovascular fitness and activity monitor agent may store hours worth of activity data while being unable to remain in communication with a manager, or it is impractical to send multiple event reports of blocks of temporarily stored measurements. After the long-term acquisition is complete, the manager retrieves the data from the agent. This mechanism is allowed in extended configurations.

6.10.2 Persistent store model

The wide range of potential combinations of data layouts makes it impractical to provide a specification for a single normative persistent store data model. As such, a cardiovascular fitness and activity monitor agent has considerable latitude in selecting the format and set of data elements to transmit. If a cardiovascular fitness and activity monitor agent supports this function, then the framework in the following subclause should be followed. The intent of this approach is to provide a "file system description" of the data layout, as opposed to a "file format specification." In other words, following the guides provided in this standard should enable an implementer to store and retrieve the data within this model, but the specifics for determining the specific nature of the data layout and the subsequent visualization, mining, or other managing of the retrieved data is outside the scope of this standard.

The cardiovascular fitness and activity monitor in this use case stores data in a number of different ways, depending on the particular needs of the acquisition. The information model for the persistent store hierarchy is shown in Figure 6. As an example and pattern, Figure 7 illustrates the relationship between the various objects for the PM-store implementation. The PM-segments could group data in different ways. It could contain all varieties of data within one session, or multiple PM-segments could be created, with one containing all distance—stride counts measurements—for the session and a second containing all distance measurements—in meters or feet—for that same session. However, the hierarchy of the PM-segment, entry, and elements should take the form shown in Figure 7.

This example illustrates a PM-store realization with two PM-segments. In this case, each PM-segment stores data from a distinct contiguous session. Figure 7 shows each PM-segment entry containing two data elements: the first representing a stride count measurement (MDC_DIM_STEP) and the second representing a distance measurement (MDC_DIM_CENTI_M or MDC_DIM_INCH). Since each entry contains the set of consistently ordered data sampled at a single point in time, one could place timestamp information in the SegEntryHdr, indicating the occurrence of each reading. If the samples are taken at fixed intervals (e.g., every minute), then the start time and sampling interval should be stored in the PM-segment attributes MDC_ATTR_TIME_START_SEG and MDC_ATTR_TIME_PD_SAMP, and the SegEntryHdr may be left empty, whereas if the samples are not taken at fixed intervals (e.g., every kilometer), the timestamp of each sample must be stored in each SegEntryHdr.

See an alternative use of the PM-store in Figure 8 where PM-segments are overlapping in time, the first segment representing a stride count measurement (MDC_DIM_STEP), and the second recording a distance measurement (MDC_DIM_CENTI_M or MDC_DIM_INCH).

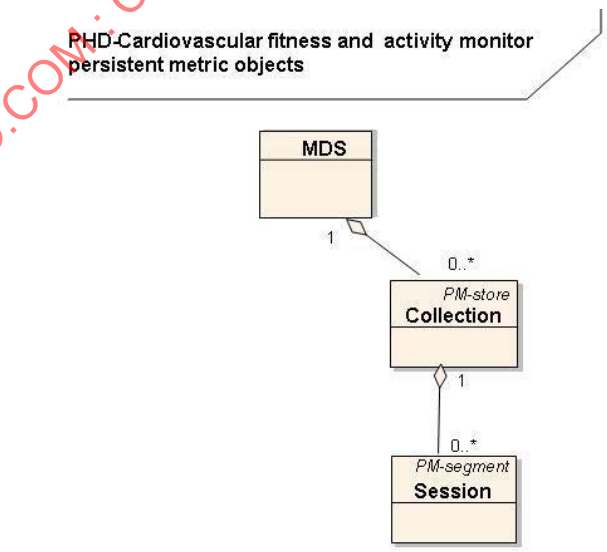

Figure 6—Cardiovascular fitness and activity monitor DIM for the PM-store hierarchy

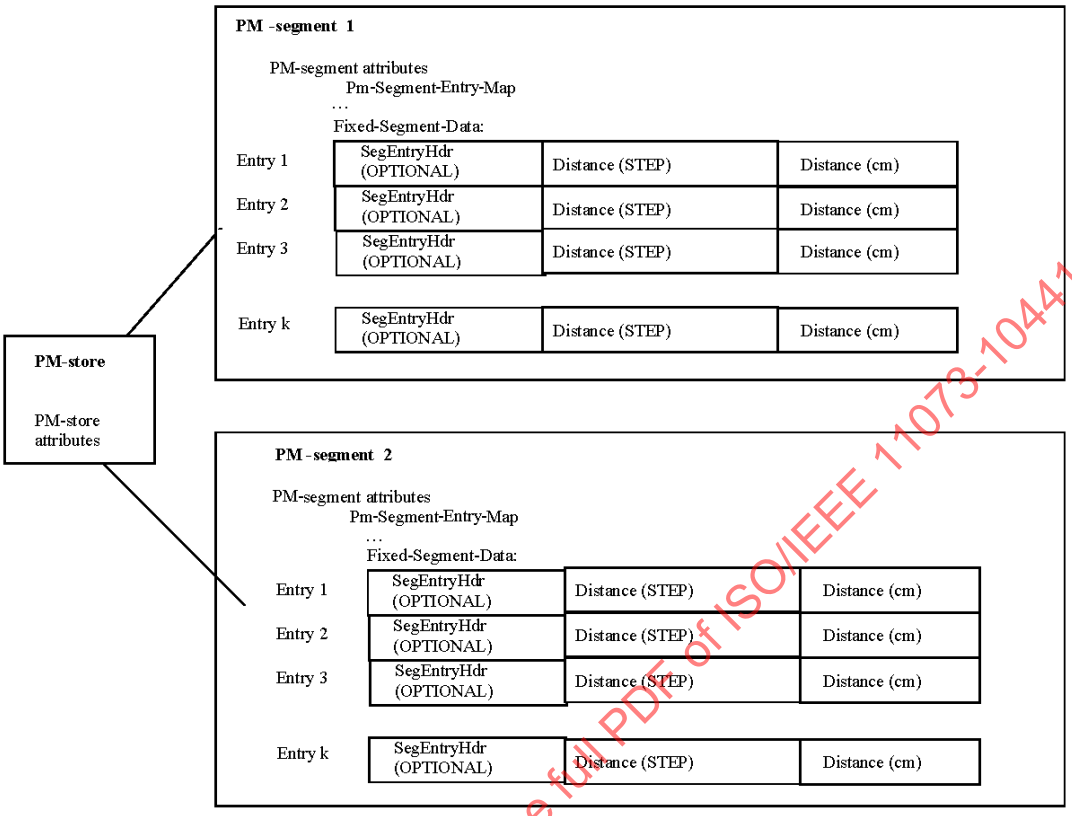

Figure 7—PM-store usage for cardiovascular fitness and activity monitor

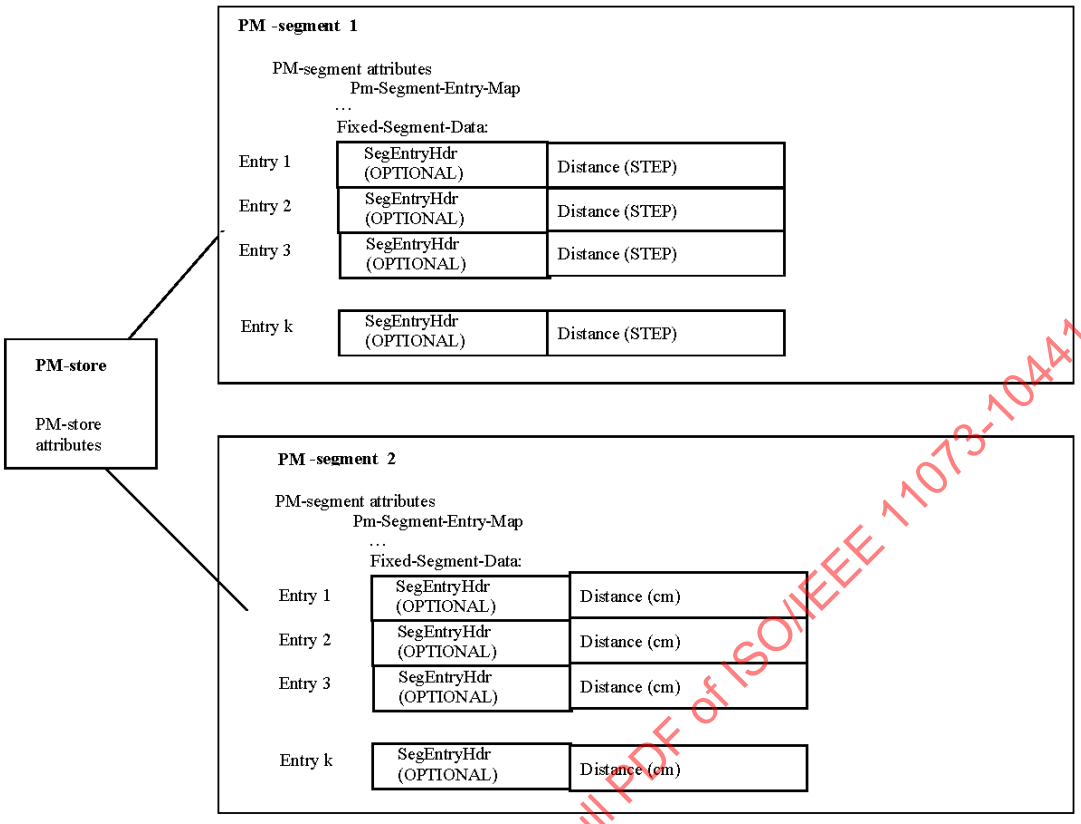

Figure 8—Alternative PM-store usage for cardiovascular fitness and activity monitor

Service components should organize their stored measurements as shown in Figure 7 and Figure 8. The order of Distance (STEP) and Distance (cm) is defined in the SegEntryMap.

Service components shall store the start time and end time in the PM-Segment attributes MDC_ATTR_TIME_START_SEG and MDC_ATTR_TIME_STOP_SEG. This enables the manager to determine whether one ore more PM-segments are associated.

Any measurements that are to be considered to be associated with one another shall be within one or more PM-segments referenced by a single PM-store. Associated measurements should preferably be within the same segment, but they at least need to be within the same PM-store.

Two or more PM-segments in a PM-store shall be considered to be associated if their start and end segment attributes are overlapping, or if one PM-segment's time range is contained within another segment. If measurements are not within the same PM-segment, there is a way to establish association between measurements.

6.10.3 PM-store object attributes

Table 49 lists the attributes for the PM-store object.

Table 49—PM-store object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
PM-Store-Capab	See IEEE Std 11073-20601a-2010.	M
Store-Sample-Algorithm	See IEEE Std 11073-20601a-2010.	M
Store-Capacity-Count	See IEEE Std 11073-20601a-2010.	O
Store-Usage-Count	See IEEE Std 11073-20601a-2010.	O
Operational-State	See IEEE Std 11073-20601a-2010.	M
PM-Store-Label	See IEEE Std 11073-20601a-2010.	O
Sample-Period	See IEEE Std 11073-20601a-2010.	C
Number-Of-Segments	See IEEE Std 11073-20601a-2010.	M
Clear-Timeout	See IEEE Std 11073-20601a-2010.	M

NOTE—See 6.3 for a description of the qualifiers.

Components *shall* set the PM-Store Object Attributes as defined in Table 49.

If the measurements are periodic and the Sample-Period is not defined in each component's PM-Segment object attributes, it *shall* be defined in the PM-Store attribute. If the Sample-Period is defined in both the PM-Store and the PM-Segment(s), then the PM-Segment attribute value *shall* take precedence. Note that if all Sample-Periods are the same in all PM-segments, it is advised defining this attribute in the PM-store to reduce the SegmentInfoList payload size.

Periodic measurements *shall* be aligned such that the first measurement is at the same time as the starting time stamp. This need is expressed to align events in case two associated PM-segments have widely varying sample periods.

6.10.4 PM-store object methods

Table 50 defines the methods used by the PM-store object.

Table 50—PM-store object methods

Service	Subservice type name	Mode	Subservice type (action-type)	Parameters (action-info-args)	Results (action-info-args)
ACTION	Clear-Segments	Confirmed	MDC_ACT_SEG_CLR	SegmSelection	—
	Get-Segment-Info	Confirmed	MDC_ACT_SEG_GET_INFO	SegmSelection	SegmentInfoList
	Trig-Segment-Data-Xfer	Confirmed	MDC_ACT_SEG_TRIG_XFER	TrigSegmDataXferReq	TrigSegmDataXferRsp

6.10.5 PM-store object events

Table 51 defines the events sent by the PM-store object.

Table 51—PM-store object events

Event	Mode	Event type	Event info parameter	Event-reply-info
Segment-Data-Event	Confirmed	MDC_NOTI_SEGMENT_DATA	SegmentDataEvent	SegmentDataResult

To facilitate a practical level of device support, a Segment-Data-Event report size shall be no larger than 8192 octets. A PM-segment containing data in excess of this size shall transfer its data using multiple Segment-Data-Event reports as described in IEEE Std 11073-20601a-2010.

6.10.6 PM-store object services

The GET service shall be provided by an agent implementing one or more PM-store objects. This service shall be available while the agent is in the Operating state. Refer to IEEE Std 11073-20601a-2010 for further details.

6.10.7 PM-segment objects

Table 52 defines the attributes of the PM-segment object contained in the PM-store object managing the stored measurements. The nomenclature code to identify the PM-segment class is MDC_MOC_PM_SEGMENT.

Table 52—PM-segment object attributes

Attribute name	Value	Qual.
Instance Number	See IEEE Std 11073-20601a-2010.	M
PM-Segment-Entry-Map	See IEEE Std 11073-20601a-2010.	M
PM-Seg-Person-Id	See IEEE Std 11073-20601a-2010.	C
Sample-Period	See IEEE Std 11073-20601a-2010.	C
Operational-State	See IEEE Std 11073-20601a-2010.	M
Segment-Label	See IEEE Std 11073-20601a-2010.	O
Segment-Start-BO-Time	See IEEE Std 11073-20601a-2010.	C
Segment-End-BO-Time	See IEEE Std 11073-20601a-2010.	C
Segment-Start-Abs-Time	See IEEE Std 11073-20601a-2010.	C
Segment-End-Abs-Time	See IEEE Std 11073-20601a-2010.	C
Date-and-Time-Adjustment	See IEEE Std 11073-20601a-2010.	C
Segment-Usage-Count	See IEEE Std 11073-20601a-2010.	O
Segment-Statistics	See IEEE Std 11073-20601a-2010.	O
Fixed-Segment-Data	Specified by vendor.	M
Confirm-Timeout	See IEEE Std 11073-20601a-2010.	O
Transfer-Timeout	See IEEE Std 11073-20601a-2010.	M

The Fixed-Segment-Data attribute serves as the container of the stored measurements. The exact data format or data type of this attribute is vendor-specific.

6.11 Scanner objects

6.11.1 General

The scanner object class is a powerful construct that enables efficient grouping of several attribute value changes from one or more metric objects into a single event report in a more efficient way than can be done by using MDS events. A scanner implementation is either episodic or periodic. It is also helpful in conveying the continuous nature of annunciations expressed within enumeration objects, as the scanner object can periodically dispatch scan event reports dedicated to a particular part of status recording when the period reported in the Reporting-Interval attribute expires. The information model for the scanner hierarchy is shown in Figure 9 containing two optional scanner objects. PeriCfgScanner objects are used to send reports containing periodic data. EpiCfgScanner objects are used to send reports containing episodic data, that is, data not having a fixed period between each data value. Note that periodic or episodic configurable scanners objects are part of the extended configurations for the physical activity monitor profile defined in this standard in Clause 12.

For details on scanner triggers, please refer to IEEE Std 11073-20601a-2010.

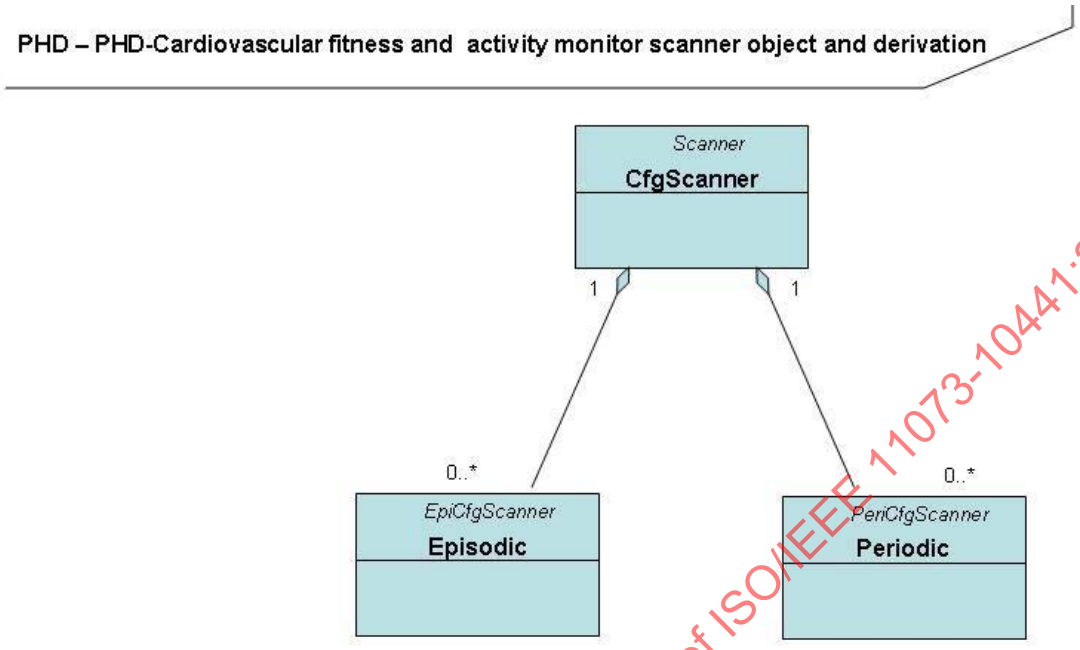

Figure 9—Cardiovascular fitness and activity monitor DIM for the configurable scanner object

Figure 10 illustrates an example collection of data that would be periodically transmitted as an associated block of information for a periodic configurable scanner. This construct enables the packaging of data as an associated set of measurements.

Scan report 1	Absolute Time	Distance	Heart Rate	3D Acceleration_X data sample	3D Acceleration_Y data sample
Scan report 2	Absolute Time	Distance	Heart Rate	3D Acceleration_X data sample	3D Acceleration_Y data sample
Scan report 3	Absolute Time	Distance	Heart Rate	3D Acceleration_X data sample	3D Acceleration_Y data sample
⋮				⋮	

Figure 10—Cardiovascular fitness and activity monitor scanner object usage example

Because IEEE Std 11073-20601a-2010 requires the manager to support grouped-format event reports, a manager must support the interpretation of this object class if the agent transmits data using periodic scanner object. Otherwise, if the agent presents the bulk of its data with scanner objects, then the manager cannot receive the data presented by such an agent.

6.11.2 Periodic configurable scanner attributes

In this standard, periodic scanners are used in two ways, as follows:

— Periodic scanners shall be used for collecting the RT-SA measurement instances to regroup them into 2D or 3D vectors (e.g., the 3D angular accelerations are constructed from their pitch, roll, and yaw components).

— Periodic scanners might be used for collecting numeric objects used for the real-time measurements (e.g., heart rate, breathing rate, and providing them to the user in real-time while the session is progressing).

Table 53 shows the attributes applicable to the periodic configurable scanner object. The nomenclature code to identify the periodic configurable scanner object class is MDC_MOC_SCAN_CFG_PERI.

Table 53—Periodic configurable scanner object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Operational-State	See IEEE Std 11073-20601a-2010.	M
Scan-Handle-List	See IEEE Std 11073-20601a-2010.	C
Scan-Handle-Attr-Val-Map	See IEEE Std 11073-20601a-2010.	C
Confirm-Mode	See IEEE Std 11073-20601a-2010.	M
Confirm-Timeout	See IEEE Std 11073-20601a-2010.	O
Transmit-Window	See IEEE Std 11073-20601a-2010.	O
Reporting-Interval	See IEEE Std 11073-20601a-2010.	M

NOTE 1—See 6.3 for a description of the qualifiers.

NOTE 2—See IEEE Std 11073-20601a-2010a-2010 for information on whether an attribute is static or dynamic.

With regard to the Confirm-Mode attribute, an agent may support either or both confirmed or unconfirmed scan reports; the manager shall support both confirmed and unconfirmed scan reports.

A single periodic configurable scanner object may be employed by a cardiovascular fitness and activity monitor in order to reduce the data transmissions between the agent and the manager.

The events in Table 54 define the events sent by the periodic configurable scanner object of the cardiovascular fitness and activity monitor agent.

Table 54—Periodic configurable scanner object events

Event	Mode	Event type	Event info parameter	Event-reply-info
Buf-Scan-Report-Var	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_VAR	ScanReportInfoVar	—
Buf-Scan-Report-Fixed	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_FIXED	ScanReportInfoFixed	—
Buf-Scan-Report-Grouped	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_GROUPED	ScanReportInfoGrouped	—
Buf-Scan-Report-MP-Var	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_MP_ VAR	ScanReportInfoMPVar	—
Buf-Scan-Report-MP-Fixed	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_MP_ FIXED	ScanReportInfoMP Fixed	—
Buf-Scan-Report-MP-Grouped	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_MP_ GROUPED	ScanReportInfoMP Grouped	—

Agents that implement a periodic configurable scanner shall support the SET service for the Operational-State attribute in Table 53.

6.11.3 Episodic configurable scanner attributes

Table 55 shows the attributes applicable to the episodic configurable scanner object. The nomenclature code to identify the episodic configurable scanner is MDC_ MOC_SCAN_CFG_EPI.

Table 55—Episodic configurable scanner object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Operational-State	See IEEE Std 11073-20601a-2010.	M
Scan-Handle-List	See IEEE Std 11073-20601a-2010.	C
Scan-Handle-Attr-Val-Map	See IEEE Std 11073-20601a-2010.	C
Confirm-Mode	See IEEE Std 11073-20601a-2010.	M
Confirm-Timeout	See IEEE Std 11073-20601a-2010.	O
Transmit-Window	See IEEE Std 11073-20601a-2010.	O
Reporting-Interval	See IEEE Std 11073-20601a-2010.	M

NOTE 1—See 6.3 for a description of the qualifiers.

NOTE 2—See IEEE Std 11073-20601a-2010a-2010 for information on whether an attribute is static or dynamic.

With regard to the Confirm-Mode attribute, an agent may support either or both confirmed or unconfirmed scan reports; the manager shall support both confirmed and unconfirmed scan reports.

The events in Table 56 define the events sent by the episodic configurable scanner object of the cardiovascular fitness and activity monitor agent.

Table 56—Episodic configurable scanner object events

Event	Mode	Event type	Event info parameter	Event-reply-info
Buf-Scan-Report-Var	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_VAR	ScanReportInfoVar	—
Buf-Scan-Report-Fixed	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_FIXED	ScanReportInfoFixed	—
Buf-Scan-Report-Grouped	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_GROUPED	ScanReportInfoGrouped	—
Buf-Scan-Report-MP-Var	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_MP_ VAR	ScanReportInfoMP Var	—
Buf-Scan-Report-MP-Fixed	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_MP_ FIXED	ScanReportInfoMP Fixed	—
Buf-Scan-Report-MP-Grouped	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_MP_ GROUPED	ScanReportInfoMP Grouped	—

Agents that implement an episodic configurable scanner shall support the SET service for the Operational-State attribute in Table 53.

6.12 Class extension objects

In this standard, no class extension objects are defined with respect to IEEE Std 11073-20601a-2010.

6.13 Cardiovascular fitness and activity monitor information model extensibility rules

The cardiovascular fitness and activity monitor domain information model of this standard may be extended by including vendor-specific metrics and attributes as required. Any object or attribute extensions implemented should follow the guidelines of this standard as closely as possible.

7. Cardiovascular fitness and activity monitor service model

7.1 General

The service model defines the conceptual mechanisms for data exchange services. These services are mapped to messages that are exchanged between the agent and the manager. Protocol messages within the ISO/IEEE 11073 series of standards are defined in ASN.1. See IEEE Std 11073-20601a-2010 for a detailed description of the personal health device service model. Subclauses 7.2 and 7.3 define the specifics of object access and event reporting services for a cardiovascular fitness and activity monitor agent according to this standard.

7.2 Object access services

The object access services of IEEE Std 11073-20601a-2010 are used to access the objects defined in the domain information model of the cardiovascular fitness and activity monitor.

The following generic object access services are supported by a cardiovascular fitness and activity monitor agent according to this standard:

- GET service: Used by the manager to retrieve the implemented attribute values of the agent MDS object attributes. The list of MDS object attributes is given in 6.6.1.
- SET service: Used by the manager to set the values of the agent object attributes. There are no settable attributes defined for a cardiovascular fitness and activity monitor agent according to this standard.
- Event report service: Used by the agent to send configuration reports and measurement data to the manager. The list of event reports for the cardiovascular fitness and activity monitor device specialization is given in 6.6.3.
- Action service: Used by the manager to invoke actions (or methods) supported by the agent. An example is Set-Time action, which is used to set a real-time clock with the absolute time at the agent.

Table 57 summarizes the object access services described in this standard.

Table 57—Cardiovascular fitness and activity monitor MDS object events

Service	Subservice type name	Mode	Subservice type	Parameters	Result	Remarks
GET	<na>	<implied Confirmed>	<na>	GetArgumentSimple = (obj-handle = 0), attribute-id-list *<optional>*	GetResultSimple = (obj-handle = 0), attribute-list	Allows the manager to retrieve the value of an attribute of an object in the agent.
	<na>	<implied Confirmed>	<na>	GetArgumentSimple = (obj-handle = handle of PM-store object), attribute-id-list <optional>	GetResultSimple = (obj-handle = handle of PM-store object), attribute-list	Allows the manager to retrieve the values of all PM-store object attributes.
EVENT REPORT	MDS-Configuration-Event	Confirmed	MDC_NOTI_CONFIG	ConfigReport	ConfigReportRsp	Configuration Report to inform manager of the configuration of the agent.
	MDS-Scan-Report-Var	Confirmed	MDC_NOTI_SCAN_REPORT_VAR	ScanReportInfoVar	—	Data Report to provide dynamic data to manager for some or all of the agent's objects in variable format.
	MDS-Scan-Report-Fixed	Confirmed	MDC_NOTI_SCAN_REPORT_FIXED	ScanReportInfoFixed	—	Data Report to provide dynamic data to manager for some or all of the agent's objects in fixed format.
	MDS-Scan-Report MP-Var	Confirmed	MDC_NOTI_SCAN_REPORT_MP_VAR	ScanReportInfoMPVar	—	This is the same as MDS-Dynamic-Data-Update-Var but allows inclusion of data from multiple people.
	MDS-Scan-Report-MP-Fixed	Confirmed	MDC_NOTI_SCAN_REPORT_MP_FIXED	ScanReportInfoMPFixed	—	This is the same as MDS-Dynamic-Data-Update-Fixed but allows inclusion of data from multiple people.
	Segment-Data-Event	Confirmed	MDC_NOTI_SEGMENT_DATA	SegmentDataEvent	SegmentDataResult	
	Buf-Scan-Report-Var	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_VAR	ScanReportInfoVar		
	Buf-Scan-Report-Fixed	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_FIXED	ScanReportInfoFixed	—	
	Buf-Scan-Report-Grouped	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_GROUPED	ScanReportInfoGrouped	—	
	Buf-Scan-Report-MP-Var	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORTMP_VAR	ScanReportInfoMPVar		

	Buf-Scan-Report-MP-Fixed	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_MP_FIXED	ScanReportInfoMPFixed	—	
	Buf-Scan-Report-MP-Grouped	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_MP_GROUPED	ScanReportInfoMPGrouped	—	
	Unbuf-Scan-Report-Var	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_VAR	ScanReportInfoVar		
	Unbuf-Scan-Report-Fixed	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_FIXED	ScanReportInfoFixed	—	
	Unbuf-Scan-Report-Grouped	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_GROUPED	ScanReportInfoGrouped	—	
	Unbuf-Scan-Report-MP-Var	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_MP_VAR	ScanReportInfoMPVar		
	Unbuf-Scan-Report-MP-Fixed	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_MP_FIXED	ScanReportInfoMPFixed	—	
	Unbuf-Scan-Report-MP-Grouped	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_MP_GROUPED	ScanReportInfoMPGrouped	—	
ACTION	Set-Time	Confirmed	MDC_ACT_SET_TIME	SetTimeInvoke	—	Manager method to invoke the agent to set time to requested value.
	MDS-Data-Request	Confirmed	MDC_ACT_DATA_REQUEST	DataRequest	DataResponse	Allows the manager to enable or disable measurement data transmission from the agent.
	Clear-Segments	Confirmed	MDC_ACT_SEG_CLR	SegmSelection	—	
	Get-Segment-Info	Confirmed	MDC_ACT_SEG_GET_INFO	SegmSelection	SegmentInfoList	
	Trig-Segment-Data-Xfer	Confirmed	MDC_ACT_SEG_TRIG_XFER	TrigSegmDataXferReq	TrigSegmDataXferRsp	Allows the manager to begin sending segment data.
SET	<na>		<na>	SetArgumentSimple		Allows the manager to control the operational state of a scanner object.

	<na>	Confirmed	<na>	SetArgumentSimple = (obj-handle = 0), attribute-id, attribute-value }	SetResultSimple = (obj-handle = 0), attribute-valuet	Allows the manager to set the value of the following attributes of an object in the agent. {Age, Body height, Body weight, Calories ingested, Carbohydrate calories ingested, Maximum recommended heart rate, Maximum recommended heart rate, Sample-period-PM-Store, Sample-period-raw-data, Sample-period-session, sustained physical activity threshold, TAT threshold}.

7.3 Object access event report services

The event report service (Table 57) is used by the agent to report its information (e.g., measurements). Event reports in this standard are a property of the MDS object only. The event reports used in this standard are defined in detail in IEEE Std 11073-20601a-2010.

The following conditions apply for a cardiovascular fitness and activity monitor agent according to this standard:

— Event reports shall be used in confirmed mode.

— Agent-initiated mode shall be supported for measurement data transmission.

An agent designed to operate in an environment where data may be collected from multiple people may use one of the multiple-person event report styles to transmit all the data from each person in a single event. If this functionality is not required, then the agent may use the single-person event report styles that have reduced overhead.

A manager shall support both single-person and multiple-person event reports. A cardiovascular fitness and activity monitor agent may support either one or both single-person and multiple-person event reports. The formats for single- and multiple-person reports are described in IEEE Std 11073-20601a-2010.

8. Cardiovascular fitness and activity monitor communication model

8.1 Overview

Subclauses 8.2 through 8.6 describe the general communication model and procedures of the cardiovascular fitness and activity monitor agent as defined in IEEE Std 11073-20601a-2010. Therefore, the respective parts of IEEE Std 11073-20601a-2010 are not reproduced, but rather the specific choices and restrictions with respect to optional elements (e.g., attributes and procedures) and specific extensions (e.g., nomenclature terms) are specified.

8.2 Communications characteristics

This standard defines no additional constraints on the communication characteristics defined in IEEE Std 11073-20601a-2010.

See communications in the profiles in 8.3 through 8.6.

8.3 Association procedure

The agent shall support protocol-version3. Support for any other version may be indicated by setting additional bits. When protocols higher than protocol-version3 are used, the agent shall continue to use only features as specified in this standard. When protocols lower than protocol-version3 are used, the agent shall use only features in that protocol.

8.4 Configuring procedure

The agent enters the Configuring state if it receives an association response of accepted-unknown-config. In this case, the configuration procedure as specified in IEEE Std 11073-20601a-2010 shall be followed.

8.5 Operating procedure

8.5.1 General

The communication of data and status information about the cardiovascular fitness and activity monitor agent occurs during the Operating state. If not stated otherwise, then the operating procedure for a cardiovascular fitness and activity monitor agent according to this standard shall be pursued as specified in IEEE Std 11073-20601a-2010.

8.5.2 GET cardiovascular fitness and activity monitor MDS attributes

See Table 4 for a summary of the GET service.

If the attribute-id-list field in the roiv-cmip-get service message is empty, then the cardiovascular fitness and activity monitor agent shall respond with a rors-cmip-get service message in which the attribute-list contains a list of all implemented attributes of the MDS object.

If the manager requests specific MDS object attributes, indicated by the elements in attribute-id-list, and the agent supports this capability, then the cardiovascular fitness and activity monitor agent shall respond with a rors-cmip-get service message in which the attribute-list contains a list of the requested attributes of the MDS object that are implemented. It is not required for a cardiovascular fitness and activity monitor agent to support this capability. If this capability is not implemented, then the cardiovascular fitness and activity monitor agent shall respond as specified in the MDS object attributes subclause in IEEE Std 11073-20601a-2010.

8.5.3 Measurement data transmission of temporarily stored measurements

See Table 3, Table 52, Table 54, and Table 56 for a summary of the event report services available for measurement data transfer.

To limit the amount of data being transported within an application protocol data unit (APDU), the cardiovascular fitness and activity monitor agent shall not include more than 25 temporarily stored measurements in a single event report. If more than 25 pending measurements are available for transmission, then they shall be sent using multiple event reports or using the PM-store mechanism. If

multiple cardiovascular fitness and activity monitor measurements are available, then up to 25 measurements should be transmitted within a single event report. Alternatively, they may be transmitted using a single event report for each cardiovascular fitness and activity monitor measurement. However, the former strategy is recommended to reduce overall message size and power consumption.

8.6 Time synchronization

Time synchronization between a cardiovascular fitness and activity monitor agent and a manager may be used to coordinate the clocks used when reporting physiological events. Note that the mechanism for synchronizing an agent to a manager is outside the scope of this standard. If time synchronization is used, then this shall be reported in the Mds-Time-Info attribute of the MDS object.

9. Test associations

Because of the large diversity of standards encompassed by the cardiovascular fitness and activity monitor standard, this standard does not define any test associations.

10. Conformance

10.1 Applicability

This standard shall be used in conjunction with IEEE Std 11073-20601a-2010.

An implementation or a system can conform to the following elements of this standard:

- Domain information model class hierarchy and object definitions (object attributes, notifications, methods, and data type definitions)
- Nomenclature code values
- Protocol and service models
- Communication service model (association and configuration)

10.2 Conformance specification

This standard offers levels of conformance with respect to strict adherence to the standard device and the use of extensions for the following:

- Information model of a specific device
- Use of attributes, value ranges, and access methods

A vendor shall specify the level of conformance for an implementation based on this standard and provide details of the way in which the definitions of this standard and any extensions are applied.

Specifications shall be provided in the form of a set of ICS as detailed in 10.4.

This standard is used in conjunction with IEEE Std 11073-20601a-2010. It is recommended that the ICS for this standard be created first so that the ICS created for IEEE Std 11073-20601a-2010 may refer to the ICS for this standard where applicable.

10.3 Levels of conformance

10.3.1 General

This standard defines the following levels of conformance for applications.

10.3.2 Conformance level 1: Base conformance

The application uses elements of the information, service, and communication models (object hierarchy, actions, event reports, and data type definitions) and the nomenclature scheme defined in IEEE Std 11073-20601a-2010 and the ISO/IEEE P11073-104zz documents. All mandatory features defined in the object definition tables and in the ICS tables are implemented. Furthermore, any conditional, recommended, or optional features that are implemented shall follow the requirements in IEEE Std 11073-20601a-2010 and the ISO/IEEE P11073-104zz documents.

10.3.3 Conformance level 2: Extended nomenclature (ASN.1 and/or ISO/IEEE 11073-10101)

Conformance level 2 meets conformance level 1 but also uses or adds extensions in at least one of the information, service, or nomenclature models. Extensions to nomenclature codes shall conform to the ISO/IEEE 11073-10101 framework and lie within the private nomenclature extension range (0xF000 – 0xFFFF).

Extensions to the information or service models shall be fully defined using ASN.1 where appropriate and have their behavior fully described following the framework of IEEE Std 11073-20601a-2010 and/or ISO/IEEE 11073-20101:2004 [B8]. All extensions shall be specified and include reference to the definition for the extension, or where no publicly available reference is available, the definition of the extension should be appended to the conformance statement.

10.4 Implementation conformance statements

10.4.1 General format

The ICSs have to be supplied in the form of tables. Subclauses 10.4.2 through 10.4.5 contain templates for these ICS tables. The tables have to be filled out and provided as an overall conformance statement document.

Generally the column headings of an ICS table contain the following information:

Index	Feature	Reference	Req./Status	Support	Comment

The table column headings have the following meaning:

— Index: An identifier (e.g., a tag) of a specific feature.

— Feature: Briefly describes the characteristic for which a conformance statement is being made.

— Reference: To the clause/paragraph within this document or an external source for the definition of the feature (may be empty).

— Req./Status: Specifies the conformance requirement (e.g., mandatory, recommended, etc.). In some cases, this standard does not specify conformance requirements but requests the status of a particular feature be provided.

— Support: Specifies the presence or absence of a feature and any description of the characteristics of the feature in the implementation. This column is to be filled out by the implementer.